

Compendium of Research in the Northwest Territories **2008**



This publication is a collaboration between the Aurora Research Institute, the Canadian Department of Fisheries and Oceans, Department of Environment and Natural Resources, Government of the Northwest Territories and the Prince of Wales Northern Heritage Centre. Thank you to all who submitted a summary of research or photographs, and helped make this publication possible.

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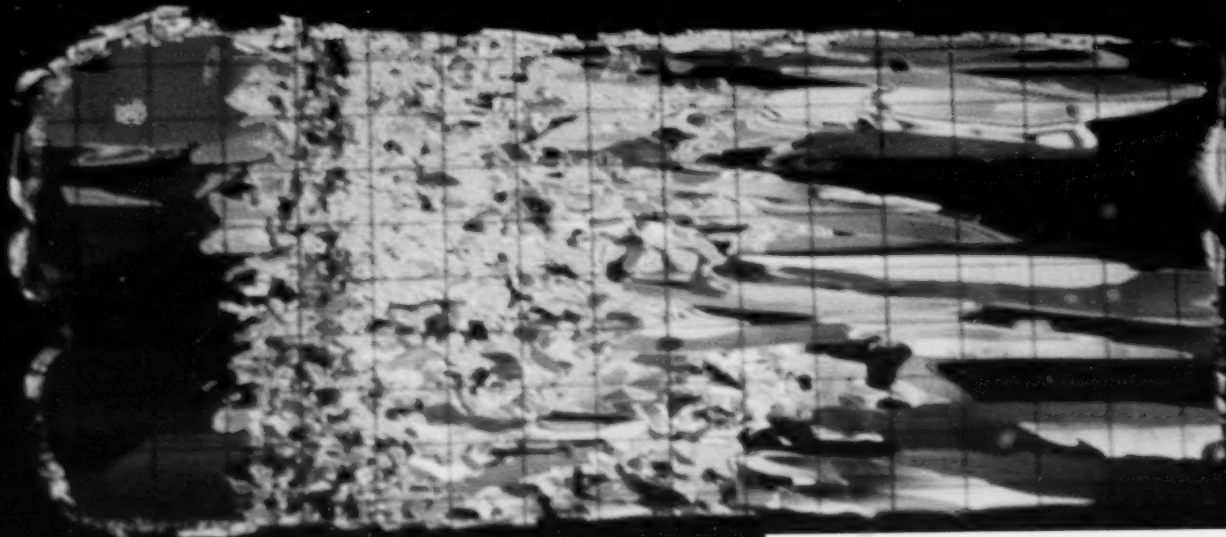


Northwest
Territories Environment and Natural Resources



Northwest
Territories Education, Culture and Employment





Foreword

Photo Credit: Joost Van Der Sanden, Natural Resources Canada

I am pleased to present you with the *2008 Compendium of Research in the Northwest Territories*. This collaboration between the Aurora Research Institute, Department of Environment and Natural Resources (ENR), Department of Fisheries and Oceans (DFO) and the Prince of Wales Northern Heritage Centre is our annual publication of all licenced research summaries in the Northwest Territories (NWT). Each agency is responsible for the implementation and/or facilitation of consultation prior to the research as well as helping direct researchers on reporting results back to the affected communities. This compendium represents a starting point to find contact information and brief abstracts on the state of the research world in the NWT.

As part of the North, the NWT continues to be recognized by all levels of government as an important location for research. For the past two years, funds from the International Polar Year (IPY) have further focused international attention on the often times, rapidly changing North. The health and well-being of northern residents was identified as a priority under IPY, and communities and all levels of government have recognized the importance of research in this area. As a result, there has been an increase in health related research across the NWT, including numerous pan-northern studies focusing on overall health and well-being, as well as community-based projects addressing localized concerns. This focus, and the ever increasing body of health and wellness knowledge, makes for an exciting time in research, and will undoubtedly inform policy decisions to support the wellness of all NWT citizens into the future.

Traditional knowledge remains an important aspect of all research in the North. It is important to note that while there are some projects in this compendium that are specifically categorized under traditional knowledge, elders, youth, hunters, wildlife monitors and community members provide their knowledge of the land, wildlife and tradition to all researchers they work and interact with. This information becomes the background against which studies are conducted and provides a unique addition to data gathered in the NWT.

We are proud of the research that is being done here in the NWT, which is ultimately adding to the global body of knowledge and solutions for all northern citizens. As we move into the future, may this caliber of such vital research continue and NWT be a place of innovative and exciting discovery.

Sincerely,

Pippa Seccombe-Hett
Director, Aurora Research Institute

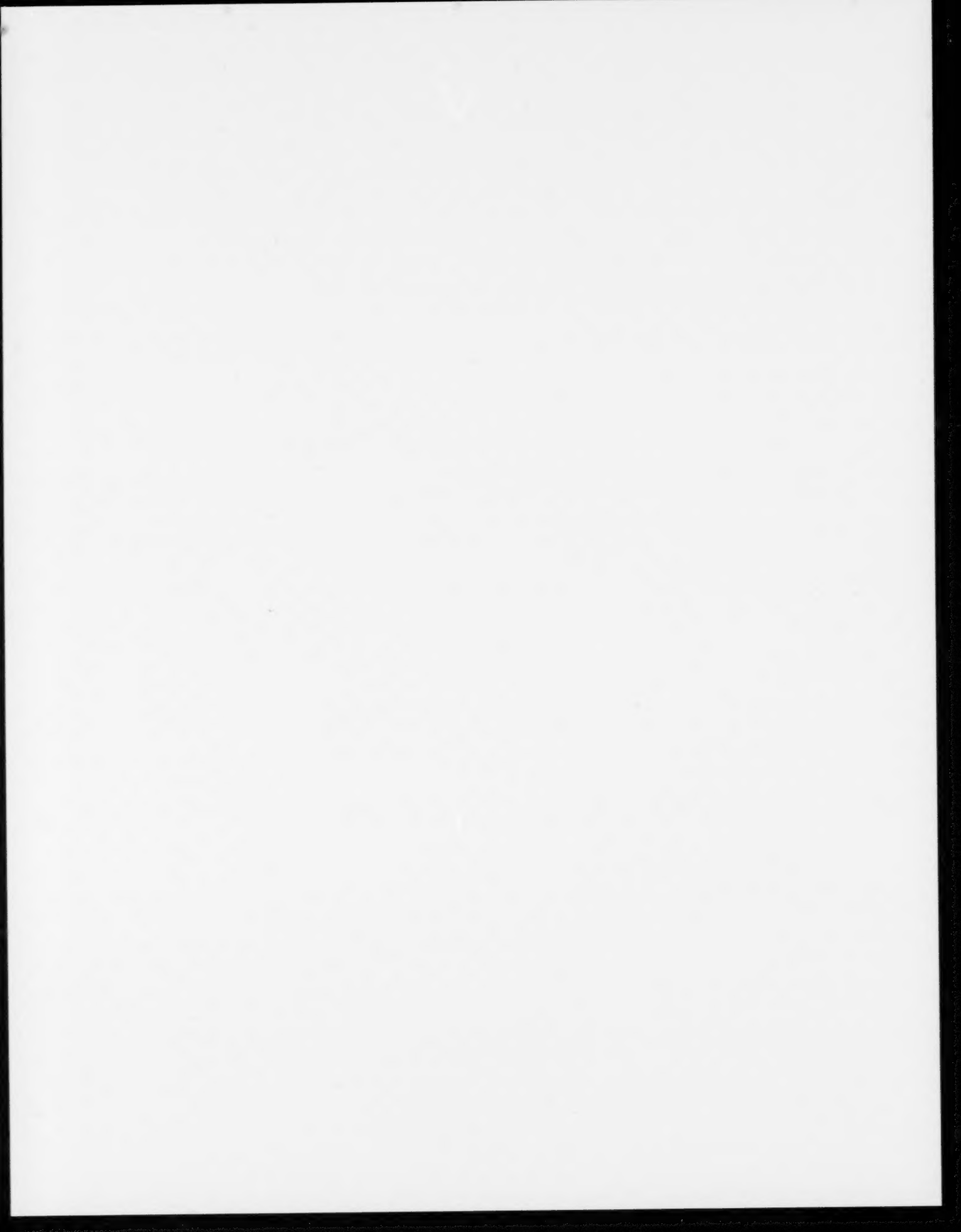




Photo Credit: Valerie Tomlinson, ARI

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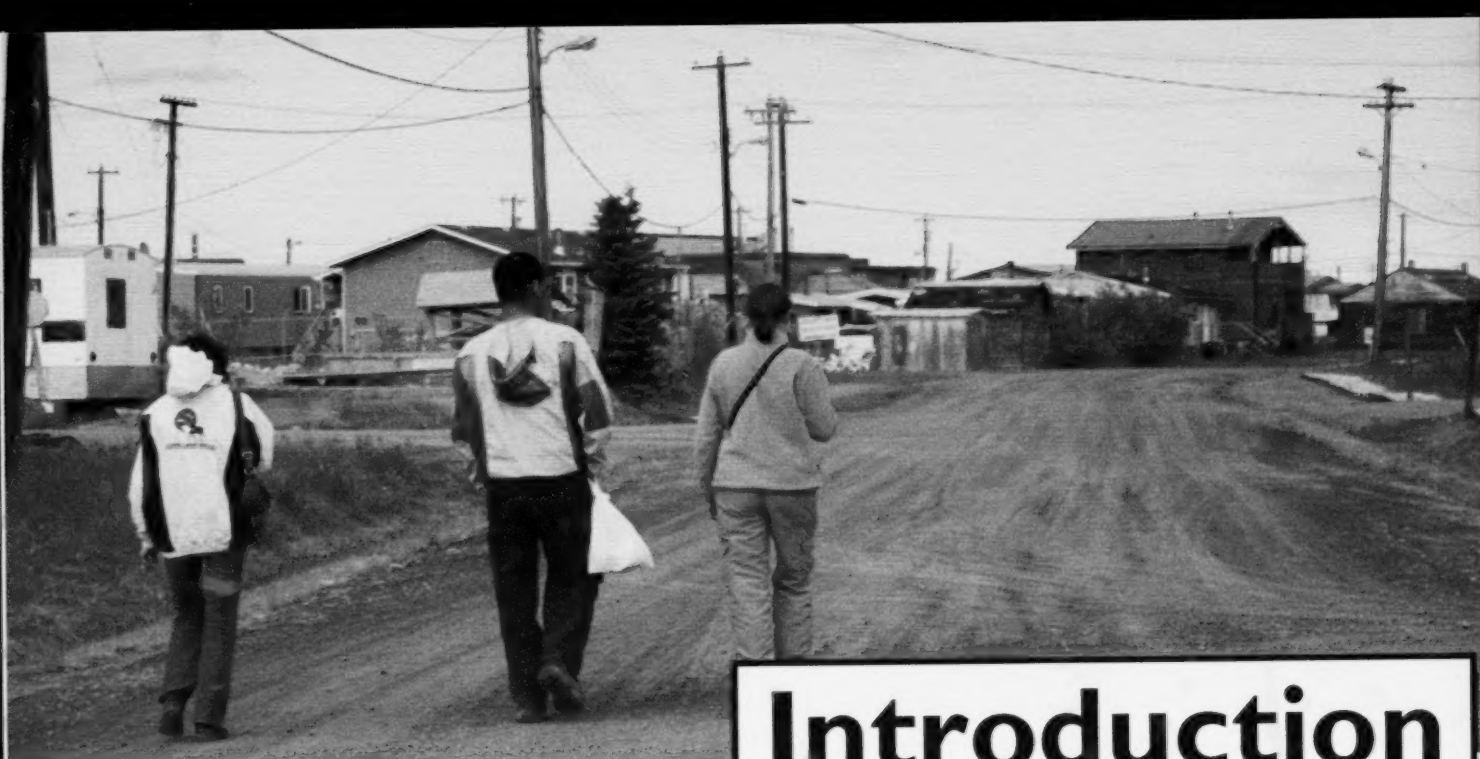


Photo Credit: William Hurst, ARI

Introduction

This compendium offers a summary of research licences/permits that were issued in the Northwest Territories during 2008. The information contained in this book is a product of collaboration between the Aurora Research Institute (ARI), the Prince of Wales Northern Heritage Centre (PWNHC), the Department of Environment and Natural Resources (ENR) and the Department of Fisheries and Oceans (DFO). The Compendium series began in 1986.

Licensing in the NWT

Under territorial legislation, all research in the NWT requires a licence/permit from one of four agencies, depending on the type of research being conducted:

- Prince of Wales Northern Heritage Centre - Archaeology;
- Department of Environment and Natural Resources, Government of the Northwest Territories - Wildlife;
- Department of Fisheries and Oceans - Fisheries;
- Aurora Research Institute - all other research in the NWT.

Through the licensing process, researchers are informed of appropriate organizations, communities and other licensing/permitting agencies that should be contacted prior to conducting studies. Licensing ensures research activities are communicated to interested parties and provides opportunities for the exchange of information.

The compendium provides a summary of all licences/permits issued in the NWT by all four licensing/permitting bodies. As each research project is represented by a short abstract, the reader is encouraged to contact the researcher for additional information and results.

How to Use This Book

This book has four main sections. Each of these sections reflects a specific licensing agency and type of licence/permit issued. Within each section, research descriptions have been grouped by subject and listed alphanumerically by the principal researcher's last name. Refer to the Table of Contents for the specific page on which each section and/or subject begins. An index is included at the end of the compendium listing all researchers in each section.

1. File Number

The file numbers shown in each of the Aurora Research Institute's subject areas refer to the file number issued to a particular researcher. It allows cross referencing with research material that may be available on file or in the ARI library. The reference numbers of the other three agencies refers directly to the permit numbers given to each researcher. When requesting information from any of these agencies on specific research outlined in the compendium, please refer to the reference number in your correspondence.

2. Regional Abbreviations

Throughout the book, reference is given to the specific land claim region(s) in which the research took place. The regions are shown on the following page. Some of the land claim regions are still under negotiation and boundaries shown are only approximations. The abbreviations shown for each region are as follows:

DC	Deh Cho	SS	South Slave
NS	North Slave	SA	Sahtu Settlement Area
IN	Inuvialuit Settlement Region	GW	Gwich'in Settlement Area

3. Glossary

A glossary of terms has been added to the Compendium. The intent of the glossary is to allow the reader to better appreciate the research descriptions.

4. Nomenclature for birds' names

Bird names are capitalized, according to the guidelines of the American Ornithologists' Union Check-list of North American Birds.

5. International Polar Year

Projects that have received International Polar Year funding in 2008 will be noted by the following symbol:



Available in Print or Free Download

This compendium is available as a printed publication or can be downloaded from the Aurora Research Institute's website (www.nwtresearch.com). Copies can also be requested by contacting the Aurora Research Institute.

Send Us Your Comments

Whether you are a researcher or an interested member of the public, the Aurora Research Institute welcomes your comments and suggestions concerning this publication. Contact us by mail, fax, email or telephone (see address on page v).



Land Claim Regions in the Northwest Territories



Photo Credit: Donald Ross, ARI

Aurora Research Institute

The Aurora Research Institute's mandate is to improve the quality of life for NWT residents by applying scientific, technological and indigenous knowledge to solve northern problems and advance social and economic goals.

ARI is responsible for:

- licensing and coordinating research in accordance with the NWT Scientists Act: this covers all disciplines including the physical, social, biological sciences and traditional knowledge;
- promoting communication between researchers and the people of the communities in which they work;
- promoting public awareness of the importance of science, technology and indigenous knowledge;
- fostering a scientific community within the NWT which recognizes and uses the traditional knowledge of northern aboriginal people;
- making scientific and indigenous knowledge available to the people of the NWT;
- supporting or conducting research and technological developments which contribute to the social, cultural and economic prosperity of the people of the NWT.

For more information, contact ARI at:



Aurora Research Institute

PO Box 1450

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Fax: 867-777-4264

E-mail: licence@nwtresearch.com

Website: www.nwtresearch.com



Photo Credit: Donald Ross, ARI

The Government of the Northwest Territories' Department of Environment and Natural Resources (ENR) has a mandate to promote sustainable development through the management and protection of the quality, diversity and abundance of natural resources and the integrity of the environment.

The Department of Environment & Natural Resources

With respect to permitting for research and monitoring, ENR is responsible for issuing Wildlife Research Permits under the Wildlife Act (Section 24) for all studies on wildlife or wildlife habitat in the Northwest Territories. Wildlife includes all vertebrates, except fish and marine mammals.

For more information, contact ENR at:

Wildlife Division

Environment and Natural Resources
Government of the Northwest Territories
PO Box 1320

Yellowknife, NT X1A 2L9

Fax: 867-873-0293

E-mail: wildliferesearch_permit@gov.nt.ca

Website: www.nwtwildlife.com/ResearchPermits/



Northwest
Territories Environment and Natural Resources

Photo Credit: William Hurst, ARI

Department of Fisheries and Oceans

The Department of Fisheries and Oceans Canada (DFO) is responsible for developing and implementing policies and programs in support of Canada's scientific, ecological, social and economic interests in oceans and fresh waters. Some Fisheries management responsibilities have been delegated or transferred to other federal agencies (e.g. Parks Canada), provinces/territories and co-management groups under Land Claim agreements.

DFO Fisheries Management is responsible for issuing Commercial, Domestic, Licence to Fish for Scientific Purposes (LFSP), Exploratory, Public Display and Educational licences in the NWT. Subject to Land Claim agreements, a Commercial licence is required to sell or barter fish.

All individuals fishing for scientific purposes or participating in the acts described below are required to obtain a Licence to Fish for Scientific Purposes (LFSP):

- activities involving fishing, catching or attempting to catch fish;
- activities where the potential exists for the incidental capture of fish;
- sampling or possessing fish caught in a subsistence fishery.

For further information about licensing, contact DFO at:

Licensing Officer
Central & Arctic Region
Government of Canada
Fisheries and Oceans Canada
PO Box 1871
Inuvik, NT X0E 0T0
Tel: (867) 777-7500 Fax: (867) 777-7501
email: xca-inuvikpermit@dfo-mpo.gc.ca
Website: <http://www.dfo-mpo.gc.ca/index-eng.htm>



Fisheries and Oceans
Canada

Pêches et Océans
Canada



Photo Credit: Valerie Tomlinson, ARI

Prince of Wales Northern Heritage Centre

The Prince of Wales Northern Heritage Centre (PWNHC), a division of the Department of Education, Culture and Employment, Government of the Northwest Territories, is responsible for managing and protecting the archaeological resources of the NWT. Representing a continuous human occupation stretching back over 7000 years, archaeological sites are fragile and non-renewable and are protected from disturbance by legislation, regulation and policy in the NWT. There are currently about 6000 archaeological sites recorded in the NWT, though this number represents only a fraction of the existing sites, as large areas remain unexplored for archaeological resources. A large part of the work done at the PWNHC involves reviewing land use and development permit applications. On average, 300 permits are reviewed per year, with recommendations being proffered to nine land management authorities.

- With respect to permitting for research and monitoring, PWNHC is responsible for issuing NWT Archaeology Research Permits.

For more information, contact the Prince of Wales Northern Heritage Centre at:

NWT Cultural Places Program
Prince of Wales Northern Heritage Centre
4750 48th Street
PO Box 1320
Yellowknife, NT, X1A 2L9
Phone: 867-873-7551
Fax: 867-873-0205
Email: archaeology@gov.nt.ca
Website: www.pwnhc.ca

2008 Licenced Research Projects

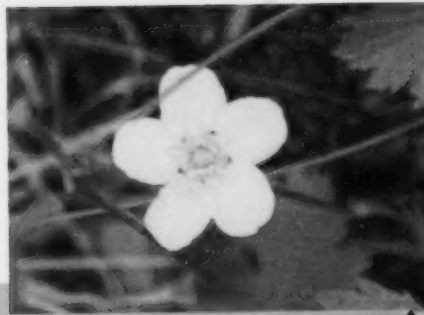


Photo Credits: Joost Van Der Sanden, Natural Resources Canada, Donald Ross, ARI; Valerie Tomlinson, ARI; William Hurst, ARI



Photo Credit: Pippa Seccombe-Hett/Annika Trimble, ARI

Biology

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File Number: 12 402 812

Region(s): SS

Licence Number: 14381

Location: Nonacho Lake Control Structure, Twin Gorges Forebay, Taltson River, South Valley Spillway and Trudel Creek

Dezé Energy Corporation Ltd. Taltson Expansion Project

The Taltson Hydroelectric Project proposes to add a new 36 MW power plant at the existing 18 MW Taltson Twin Gorges Plant. In order to complete the effects assessment, a field work program was conducted to determine the potential impacts to fish and fish habitat. More specifically, the objectives of the 2008 field program were to: 1) evaluate the habitat at the proposed in-stream work sites and identify potential impacts to fish and fish habitat; 2) quantify the anticipated changes to fish and fish habitat at the in-stream works locations; and 3) evaluate the littoral habitat zones of Nonacho Lake.

At each of the identified in-stream work sites (Nonacho Control Structure, the North Gorge and the South Valley Spillway) all in-stream habitat types were identified and quantified. In addition, fish sampling was conducted at each site to determine fish use. Sampling methods included angling, electro-shocking and snorkel surveys. Over the course of this research: 18 Northern Pike, 2 Walleye and more than 1000 white sucker fish were observed.

Linear transect vegetation assessments were conducted within Nonacho Lake and Trudel Creek to identify vegetation types and transition zones, or shifts, in the vegetation communities. Fish sampling was also conducted in the littoral habitats and included electro-shocking and seine netting.

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File Number: 12 402 819

Region(s): IN, GW, DC, SA

Licence Number: 14428

Location: Inuvik, Fort Good Hope and Fort Simpson

 2007-2008 API-IPY

Developing Options for Community-Based Protocols to Detect Invasive Alien Plants and Insects in the Northwest Territories

The main objectives of this project were 1) to consult with communities about their views of community-based protocols for monitoring and reporting the presence and spread of introduced plant and insect species to the territorial government; and 2) to determine community interest in developing or expanding local agricultural opportunities. This project was interested in non-native or non-indigenous species in the NWT in particular invasive species which may bring undesirable economic and biological impacts.

Monitoring projects have been established elsewhere in the north using local people to monitor the arrival and spread of potentially invasive plants and insects. At Fort Good Hope, Fort Simpson and Inuvik the awareness of and interest in this invasive plant issue was surveyed. Local community members were asked about their interest in increasing the benefits of introduced plants, by increased availability of greenhouses and community-gardens. With suggestions from local communities, who expressed much interest, a draft protocol for Environment and Natural Resources (GNWT) was developed that allows community-based reporting of the arrival of new plant and insect species. This protocol can be tailored to the preferences of each community. The recommendation that this program be linked with local community-based agriculture programs was also made.

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File Number: 12 402 799
Region(s): SA

Licence Number: 14297
Location: Nota Creek C-17 wellsite (65° 06' 01" N, 126° 02' 58" W)

Phytoremediation Study on the CDN Forest et al Nota Creek C-17 Wellsite

Phytoremediation is a remediation strategy involving the use of plants to remove contaminants. In theory, plants uptake the contaminant from the soil, then are harvested and removed from the site. This process was repeated until the impacted soil was remediated to applicable guidelines. Laboratory and greenhouse testing using soil samples collected from the salt-impacted Nota Creek C-17 wellsite had shown encouraging phytoremediation results and supported proceeding with the planting of on-site test plots in 2008.

Equipment necessary for the planting and harvesting operations was delivered to the wellsite in late March 2008 under frozen ground conditions. Personnel helicoptered to the wellsite in mid-June 2008 and prepared three 10m x 30m test plots in areas with varying degrees of salt impact. The plots were then planted with alternating treated and untreated red fescue-slender wheatgrass blends. Plant health and vigor was assessed during a monitoring trip made to the wellsite in mid-August. In late September 2008, personnel were mobilized to the site to collect plant and soil samples off the test plots, to harvest the growth on the plots and to remove the new growth from the site. Initial results for the test plot planting were positive and support proceeding with a 2009 phytoremediation planting of the full wellsite.

Cote, Jason

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Suite 202 - 4548 Lakelse Avenue
Terrace, BC V8G 1P8
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File Number: 12 402 820
Region(s): NS

Licence Number: 14429
Location: La Martre River immediately upstream of the La Martre River Falls
(63° 8'0.48"N, 116°54'3.50"W)

Nailii Hydroelectric Project

The Nailii Hydroelectric Project is a run-of-river hydroelectric development that proposes to construct a new 1.2 MW power plant to service the Community of Whatl. In order to complete the effects assessment, a field work program was conducted to determine the potential impacts to fish and fish habitat. More specifically, the objectives of the 2008 field program were to: 1) categorize habitat types within the diversion reach and ground truth conditions wherever possible; 2) identify and quantify key fish habitat present in the diversion reach; and 3) determine fish species presence and/or use of the habitats associated with the diversion reach.

A total of 11 sites were visited within the diversion reach, of which four distinct habitat types were identified and sampled. These habitat types include: 1) turbulent waters characterized by rapids and chutes and dominated by bedrock; 2) riffle-pool channels dominated by cobbles and gravels and no in-stream vegetation; 3) moderate to fast flowing riffle-pool habitats dominated by bedrock and large boulders; 4) slow moving waters with dense in-stream submergent vegetation.

A total of 38 fish were captured during the field program including: 7 White Suckers, 4 Arctic Grayling, 2 Northern Pike, 11 Slimy Sculpin, 13 Nine-spine Stickleback and 1 Burbot. Within the diversion reach, three areas were identified to provide key habitat. These habitat areas identified include a braided channel network, a small area dominated by fractured bedrock and small holding pools along the stream margins of highly turbulent areas.

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File Number: 12 402 804
Region(s): IN, GW, SA, DC

Licence Number: 14345

Location: Within the municipal boundaries of Inuvik, Fort Good Hope and Fort Simpson

Impacts of Oil and Gas Activity on the Peoples in the Arctic Using a Multiple Securities Perspective

As part of the International Polar Year project 'The Impacts of Oil and Gas Activity on Peoples in the Arctic Using a Multiple Securities Perspective' this study focused on the potential impacts that the future Mackenzie Valley Oil and Gas pipelines may have on plant community structures. Sampling occurred in Fort Simpson, Norman Wells, Fort Good Hope and Inuvik, with each location selected according to different disturbance levels. The Norman Wells pipeline provided a reference site for comparison to sites with no pipeline activity and/or roads. Point-line transects using 1m x 1m quadrats were sampled along with community consultations. This attempted to identify existing gradients of disturbance, species distributions of native and existing invasive alien species, and to document tradition ecological knowledge about plant changes. It was predicted that the pipelines will assist in a measurable amount of disturbance affecting baseline species composition and increasing the rate of invasive alien species movement. Preliminary analysis of plant communities suggests a change in vegetation along disturbances and an increased number of alien invasive species in disturbed areas. Results of the project are being developed into an integrated community monitoring program for invasive alien species with the Government of Northwest Territories, Environment and Natural Resources.

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File Number: 12 402 806
Region(s): SA

Licence Number: 14349

Location: Ten waterbodies in the SW region of the Sahtu Settlement Area, and a small portion in NW Deh Cho region

Selwyn Project Fisheries Baseline Study

The objective of this study is to determine fish presence, distribution and abundance in water bodies in the Selwyn Project area. Fish presence and habitat conditions were evaluated for the five bridge crossing locations along the Access Road. Fish capture methods included electrofishing, minnow trapping and live netting. Fish were present at two crossings; Mac Creek (47 fish) and Guthrie Creek (2 fish). Slimy sculpin and arctic grayling were found at both locations. The presence of fry at both locations indicates the possibility of spawning habitat in areas upstream of the bridge crossings. Habitat observations show moderate habitat potential at the Mac Creek crossing location. Secondary channels provide potential rearing habitat for fry and juveniles. These channels may also impact fish by stranding them from the main channel and they may die during the winter months when the channels dry up or freeze solid. Steel Creek may also provide a moderate fish habitat. It is a large stream with a range of different of habitat features.

Current and historic sampling efforts have failed to capture or observe any fish in this stream. A steep cascade near the confluence with the little Nahanni River is likely a barrier to fish migration.

Habitat conditions at Fork Creek and March Creek Crossing locations are poor. No fish were observed in these streams. Fish presence is possible since there are no observable barriers to fish migration from the Little Nahanni River.

Evans, Marlene

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File Number: 12 402 503
Region(s): DC, SS

Licence Number: 14366
Location: Various locations within the Sahtu Settlement Area

Biological Studies of Waters Along the Proposed Mackenzie Gas project Pipeline Route - Sahtu Settlement Region

No research was conducted under this NWT Scientific Research Licence.

Evans, Marlene

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File Number: 12 402 503
Region(s): GW

Licence Number: 14368
Location: Various locations within the Gwich'in Settlement Area

Biological Studies of Waters Along the Proposed Mackenzie Gas Project Pipeline Route - Gwich'in Settlement Region

No research was conducted under this NWT Scientific Research Licence.

Evans, Marlene

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Saskatoon, SK S7N 3H5
marlene.evans@ec.gc.ca

File Number: 12 402 503
Region(s): DC, SS

Licence Number: 14387
Location: Various locations within the Deh Cho and South Slave Settlements

Biological Studies of Waters Along the Proposed Mackenzie Gas Project Pipeline Route - Deh Cho and South Slave Settlement Regions

This study was designed to fill in scientific gaps in Environment Canada's understanding of the structure and functioning of the aquatic environment potentially impacted by various aspects of the Mackenzie Gas Project, with a focus on creek and river systems. Over the past three years, a large database was generated for creeks and rivers along the east side of the Mackenzie River. However, no data was available for the creeks along the south shore of Great Slave Lake or for streams to the west of the Slave River. In the summer of 2008, a field study was conducted where five streams were sampled to fill in these knowledge gaps. Other streams in the areas were either too deep, flowing too slowly, or had been impacted by a recent forest fire. The data collected from this study formed part of a project which will focus on how benthic communities differ with stream type from south of Fort Smith to north on Inuvik. In addition, it will be determined if some fish species serve as indicators of stream conditions such as fast flowing waters, salty waters, etc. which can help with future monitoring.

Goad, Robin

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File Number: 12 402 697
Region(s): NS

Licence Number: 14355
Location: Within 50 kilometers of the Lou Lake camp (63° 33' N, 116° 46' W)

Environmental Surveys of Fortune Minerals NICO Project

The 2008 environmental studies at the NICO Property included an assessment of: fish and fish habitat; water and sediment quality; wildlife presence and abundance; vegetation; and geochemistry analysis of the project area. During the 2008 season, environmental surveys were conducted within a 5 km radius of the mine site (local study area) and within a 5 km buffer of the proposed road route.

Water and sediment quality surveys were conducted to build existing baseline databases of water quality from the project area, and provide a seasonal comparison among sites, thereby strengthening the project's water management strategy. As a result of the forest fire that occurred in the project area during the summer of 2008, the August water quality sampling program was expanded to include sediment samples from each waterbody in the project area. Sediment samples were collected in August 2008, to compare changes in sediment quality following the forest fire with sample collected in August 2005.

A vegetation survey collected samples to assist in the development of habitat suitability index models and further describe the local vegetation, and to assess impacts to wildlife.

Stream flow measurements were collected at selected locations with continuous flow monitoring at three locations during the sampling program, and staff gauges installed at selected lakes and ponds to monitor water levels.

Site work on the rock geochemistry aspects of the NICO project consisted of: 1) the sampling of the waste rock piles around the portals, prior to their consolidation into a single pile; 2) the sampling of outcrop rock samples at potential rock fill borrow sites; 3) the construction of field cells, to monitor tailings leachate with tailings expected to be placed in the field cells in the late spring of 2009.

Observations were submitted to Fortune Minerals NICO project office for review.

Green, Scott

University of Northern British Columbia
3333 University Way
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greens@unbc.ca



File Number: 12 402 807

Region(s): GW

Licence Number: 14352

Location: The Dempster Highway between Wright Pass and the Peel River

Treeline Dynamics in the Western Canadian Arctic

The project examined past tree growth patterns at the northern treeline in Western Canada as a baseline to predict future growth responses to climate change. Additionally, the researcher examined tree regeneration and plant associations at the northern treeline. The 2008 activities focused on measuring weather differences across the study area and on surveying forest patterns and ages. These preliminary activities help the researcher to develop the sampling design for summer 2009, when the majority of measurements will actually be collected. Preliminary observations and data suggest the forested areas in Yukon may respond differently to climate change than forested areas in NWT. Any changes in forest dynamics will impact habitat quality, plant associations and the availability of wood for fuel and other uses.

Grogan, Paul

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File Number: 12 404 687

Region(s): NS

Licence Number: 14277

Location: Daring Lake Terrestrial Ecology Research Station

Controls on Carbon and Nutrient Cycling in Arctic Tundra

Field work this year at Daring Lake related to carbon and nutrient cycling centered on two major projects: 1) The role of nematodes in nitrogen mineralisation in tundra soils; and 2) shrub-snow interactions on soil nitrogen cycling that may promote shrub expansion. The first project investigated seasonal patterns of nematode abundance and the composition of nematode feeding types. Nematode samples from dry heath, birch hummock and tall birch ecosystem

soils were extracted and counted in the field in early, mid and late summer. Finally, nematode abundance was experimentally enhanced in order to investigate their role in nitrogen mineralisation of incubated soils.

The second project focused on a major plant biomass harvest done in 2006. Fifteen labeled tall birch and birch hummock ecosystem plots were revisited to follow the fate of nitrogen among plant and soil components and to provide the first above and belowground biomass and net primary production data for Daring Lake. These plant growth data will be related to nitrogen inputs and nitrogen cycling rates for comparison with a similar experiment at Toolik Lake, Alaska.

Guthrie, Glen

Sahtu Renewable Resources Board
PO Box 381
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rrco@srrb.nt.ca

File Number: 12 402 780
Region(s): SA

Licence Number: 14308
Location: Bosworth Creek, Jackfish Lake and Edie Lake, based out of Norman Wells.

Bosworth Creek Monitoring Project

This Bosworth Creek Monitoring Project is a high resolution, long-term study of a 125 square kilometre watershed near Norman Wells. The project was initiated after the Sahtu Renewable Resources Board received a request from local residents for information on fish stocks in Bosworth Creek, following the removal of a weir in 2005 by Imperial Oil Resources. The project has focused on creating baseline biological and chemical inventories for the past two years, which are nearly complete. These permitted the focus of the investigation to broaden to include microhabitat studies, monitoring the timing, distribution and relative abundance of biotic communities and focus the investigation on issues related to climate change that appear to be affecting groundwater distribution. The project will also continue to monitor potential impacts by industry and is looking at the impact of a flare stack on locally harvested berries.

The Bosworth Creek Monitoring Project has become a permanent component of Mackenzie Mountain School's high school curriculum program through the NWT Experiential Science Program. The Bosworth Creek Monitoring Project will continue to provide professional development for local youth through associations with academic and industrial institutions. The project will continue to acquire baseline biological data, collect and assess chemical components of the creek system and continue to provide public education opportunities through presentations, workshops and publications.

Hansen, Tamara

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File Number: 12 402 813
Region(s): IN, GW

Licence Number: 14402
Location: Within the municipal boundaries of Inuvik

Do the Mosquitoes in the NWT have *Wolbachia*?

Wolbachia is a bacterium that infects many types of insects. It has been found in insects in southern Canada, but has never been tested in Northern Canada. The territory of the bacterium is important to follow due to the potential impact on the population of mosquitoes and the vector borne diseases that mosquitoes harbor. Mosquitoes were collected from several different regions within the Inuvik town limits. The insects were kept in tubes with ethanol, until they were identified down to their species. The different species were pooled together and the collective DNA from the mosquito legs was extracted and tested for the presence of *Wolbachia*. There were a total of 30 mosquitoes tested and they all had a negative result. They were also tested for two other bacteria from the same family, *Rickettsia* and *Cardinium*. These all came back with negative results as well. It has been suspected that the bacteria have not yet travelled as far as Inuvik.

Henry, Greg

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API-IPY

File Number: 12 402 817

Region(s): IN

Licence Number: 14417

Location: Tuktoyaktuk Peninsula and Richards Island

Ecology of White Spruce at the Species Limit in North West Canada

The main objective of this research was to determine if changes in growth and reproduction have occurred in white spruce trees (*Picea glauca*) over the past 20 years in the Mackenzie Delta-Tuktoyaktuk region. Sites within the forest-tundra zone in this region were established in 1993. In 2008, five of the previously measured spruce tree island sites and three newly discovered sites were visited. A tree island is a group of spruce stems found beyond the current tree line. The stems are not from seeds, but are branches from an older stem that have begun to grow upright.

Cones were collected from all tree islands that produced them. Seeds were tested for germination, which was very low. A core was taken from the largest stem in each of the tree island sites and the rings were counted to determine the age. The ages of the stems ranged from about 1850 to 1965. In some of the sites, seedlings had been planted in 1994 and surviving seedlings were relocated and counted. Survivorship of the seedlings ranged from 0 to 24%. Measurements of tree height and diameter were also made at each site. Soil samples were collected from each site and analyzed for moisture, pH and nutrients.

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Region(s): NS

Licence Number: 14322

Location: Daring Lake Tundra Ecosystem Research Station

Conceptual and Mechanistic Models for the Development and Survival of the Trichostrongylid, *Ostertagia gruehneri*, in Barren-ground Caribou, With Respect to Northern Climate Change

This project investigated the impact of climate change on the development, survival and transmission of the most common stomach parasite of barren-ground caribou, *Ostertagia gruehneri*. The first objective of this project was to determine the development and survival rates of *O. gruehneri* on the tundra under natural and artificially warmed conditions. Fecal samples containing *O. gruehneri* eggs were put on the tundra under natural conditions and in open-topped chambers that mimic climate change. Samples were monitored throughout the summer and larvae recovered from the samples were counted and identified to development stage. Development and survival data collected during the 2008 field season are currently being analyzed. Preliminary findings suggest that development rate was not constant throughout the summer and was restricted in both the coldest and warmest periods of the season. Survival rates differed between the two treatments (natural versus warmed) and more infective larvae were recovered from the plots under warmed conditions.

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Region(s): NS, SS

Licence Number: 14319

Location: Snap Lake and the regional study area (33 km radius of camp)

De Beers Snap Lake Mine - 2008 Environmental Monitoring Program

The objective of the monitoring programs was to collect annual data pertaining to terrestrial and aquatic resources to monitor and compare project related effects with the environment assessment predictions and comply with the Mine's regulatory requirements as outlined in the Project's Water License, Environmental Agreement, Land Use Permit, Fisheries Authorization and Land Leases.

The aquatics program included water quality, sediment quality, benthic invertebrates, plankton and fish health monitoring. Vegetation, air quality and hydrology (surface water monitoring) studies also occurred on site.

Members of aboriginal communities participated in facets of these studies and provided input on fish palatability, aquatic sampling and wildlife surveys. Results of the programs will be submitted as part of the 2008 annual reporting requirements under the Mine's Water License and Environmental Agreement.

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Licence Number: 14321

Location: Diavik Diamond Mine, Lac de Gras

Aquatic Effects Monitoring Program 2008

The objective of this study is to determine any seasonal variation in water quality, zooplankton & phytoplankton biomass and taxonomy, benthic invertebrate analysis and sediment chemistry, and will also include dust monitoring. There were only a few open water sediment/benthic samples that could not be obtained due to hard/rocky lake bottom and some water quality and plankton stations that were not sampled in the third open water period due to inclement weather. Issues identified in the 2007 Aquatic Effects Monitoring Program were largely implemented in 2008. Special Effects Studies for mercury detection limits, chromium VI and trout fish tissue metals levels were also completed.

Overall, the 2008 Aquatic Effects Monitoring Program determined, based on the weight of evidence, that nutrients (nitrogen and phosphorus) released into Lac de Gras from the treated mine water discharge are causing mild enrichment in the bay east of the east island.

Dust gauges and snow core sampling both provide useful information on dust deposition rates and distribution around the Mine site. Dust continues to be an issue that requires ongoing management.

The analysis of effluent and water chemistry data collected during the 2008 AEMP field program and from relevant sites from the Water License Surveillance Network Program stations indicated a low level effect on water chemistry within Lac de Gras resulting from the Mine. Results of the sediment analysis did not identify conditions that are likely to affect aquatic life through enrichment or impairment. Bismuth and uranium were however assigned "high level effects" designation as both near-field and at least one mid field area had mean concentrations greater than the reference area range.

Analysis of the number and types of small organisms that live on the bottom of the lake (benthic invertebrates) indicated low level or early warning effects. Density of the midge *Procladius* in the near-field area were greater than the range measured in the reference areas and was assigned a moderate level effect. Density of *Sphaeriidae* in the near-field and mid-field areas greater than the range measured in the reference areas and was assigned a high level effect. Both results show nutrient enrichment. The fish tissue analyses from 1996, 2005 and 2008 indicate that there has been no increase in the concentration of metals, including mercury, in lake trout over that period. Findings to date on a special study to examine changes in amount, number and types of tiny animals (zooplankton) and algae (phytoplankton) that live in the water of Lac de Gras indicate a pattern consistent with nutrient enrichment from Mine effluent. Based on the measured higher amounts of phytoplankton (chlorophyll a) and total phosphorus in the near-field areas compared with the reference areas this effect has been classified as moderate. Higher zooplankton biomass near the effluent resulted in a high level effects.

Mercury and chromium VI levels in the treated mine water discharge that were the subject of special studies in 2008, were determined to be at concentrations below the best analytical detection limits available.

The weight-of-evidence analysis confirmed the nutrient enrichment effect and concluded that there is strong evidence for a mild increase in lake productivity due to nutrient enrichment and negligible evidence of impairment to lake productivity as a result of any contaminant exposure.

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File Number: 12 402 818**Region(s):** NS, SS**Licence Number:** 14422**Location:** Within and adjacent to the Thor Lake property
(62° 06' 27" N, 112° 36' 25" W)**2008 Baseline Studies for Avalon Ventures Ltd. Proposed Thor Lake Rare Earth Metals Project (Fisheries Component)**

The researchers completed a year of baseline studies for fisheries at Avalon Rare Metals Thor Lake Project. Eleven lakes, three streams and the potential Great Slave Lake dock site were examined and sampled for fish. Fish habitat in lakes were mapped by completing bathymetric (lake depth) surveys and recording types of shoreline habitat. Gillnets and minnow traps were also set in 10 lakes. Fish were captured by gill nets in seven lakes, including the potential Great Slave Lake dock site. More specifically, northern pike were caught in all lakes, lake whitefish were caught in six lakes, least cisco was caught in four lakes and lake trout and arctic grayling were caught at the potential Great Slave Lake dock site (with other species too). From these fish tissue (muscle and livers) were sampled and are being analyzed for metals and radionuclides. The second year of the baseline studies will take place in 2009.

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File Number: 12 402 805**Region(s):** NS, SS**Licence Number:** 14346**Location:** Diavik Diamond Mine, Lac de Gras**Revegetation/Reclamation Research**

The objectives of this study were to: 1) determine the effect of season for seeding/planting on shrub establishment and survival; 2) determine the effect of boulders, rocks, soil mounds and pockets on plant emergence and establishment, as well as how they influence soil structure; 3) investigate the effect of stockpiling salvaged topsoil on its potential as a soil amendment and source of native propagules for reclamation of disturbed sites; 4) investigate the ability of different substrates to retain water and increase cation exchange to help plant growth; 5) determine the best soil amendments to add nutrients to the soil to promote growth. Four types of microsites (boulders, soil mounds, depressions and flat areas) were created by hand in three substrates (gravel, till and processed kimberlite, waste rock from the diamond extraction process). Topsoil stockpiled on site was applied to half of the microsites on each treatment. Native seeds and cuttings, collected from the surrounding tundra, were planted around each microsite. Maps of each treatment were made, and the plant species at each microsite were recorded on the maps so the survival and health of individual plants could be tracked over the long term.

Survival and health of the plants will be monitored in summer 2009. Results from summer 2009 will help in determining whether future reclamation efforts at Diavik should include microsites; which microsites are most beneficial for plant establishment and survival; and which plant species are most successful in establishing plant cover on a reclaimed area.

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File Number: 12 402 797**Region(s):** SA**Licence Number:** 14343**Location:** Mountain River, Carcajou River and Great Bear River

Molecular and Otolith Tools to Investigate Population of Origin of Arctic Cisco

This study aimed to: 1) use genetics and otolith microchemistry to determine if differences exist between collections of Arctic cisco (herring) made from tributaries of the Mackenzie River and the Colville River; and 2) use differences to identify population-of-origin of fish caught in the Colville River subsistence fishery. A total of 166 Arctic cisco (*Coregonus autumnalis*, locally referred to as "herring") were collected from the Mountain, Carcajou and Great Bear rivers. Three inch gill nets were set in eddies to capture Arctic cisco. A fin clip was taken from each Arctic cisco for genetic analysis, and the ear bones (otoliths) were removed for age and migration analysis. Meat from all collected fish was distributed to local community members for personal consumption. This study was designed to help researchers and northern communities understand the population-of-origin and movement of overwintering fish collected for subsistence in the Colville River, Alaska. Sample collections were taken from Canada because all Arctic cisco are believed to spawn in tributaries of the Mackenzie River. Genetic and otolith characteristics of Canadian Arctic cisco may allow United States Geological Science researchers to discern the origin of fish captured in the Colville River subsistence fishery in Alaska.

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File Number: 12 402 412

Region(s): SS

Licence Number: 14384

Location: Forest strands on Highway #5 to Ft. Smith

Structure and Carbon Dynamics of Boreal Forests

The trend of warming climate has been progressing in the arctic regions, as rapid melting of the arctic ice suggests. The researchers expect that the same trend has been affecting ecology of boreal forests. To confirm this hypothesis, researchers set up three study plots of black spruce, and started to measure movement of carbon in those forests near Fort Smith. Carbon is the major element that moves into and out of the forests. What is necessary to quantify are the amounts of tree growth, amount of leaves and branches that fall from the trees, growth and death of tree roots, etc. There is an emerging pattern in a similar set of study plots of jack pine in Wood Buffalo National Park, where large amount of root growth were observed. Approximately 90% of newly fixed carbon by the plants (as so-called Net Primary Production) is used for production of fine roots, and only 10% is transferred as falling dead leaves and branches. This discovery suggests importance of roots in carbon dynamics of boreal forests. The researchers intend to test if a similar pattern exists in the black spruce forests by examining black spruce plots in the near future.

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Region(s): NS,SS

Licence Number: 14361

Location: Matthews Lake, Sandy Lake and surrounding area

2008 Field Monitoring - Matthews Lake and Area Fish Habitat Restoration and Enhancement Project

The objective of this fieldwork was to monitor vegetation, invertebrates and fish populations associated with lakeshore and stream habitat restoration and enhancement. Post-construction monitoring activities repeated activities of the previous year, with the addition of June egg sampling within the Stream B ford. The Salmita shoreline treatment section showed improvement in vegetation cover and natural establishment of seedlings amongst vegetation transplanted in 2004. Benthic invertebrate sampling continued to demonstrate a significant improvement in invertebrates, arthropods and dipteran larvae numbers in the treatment vs. control shoreline. The portion of the treatment area disturbed by 2006-2007 winter road construction remained un-vegetated, and willow was harvested and transplanted along the two new shoreline fingers constructed as compensation in 2007. The Pond B-Sandy Lake embayment continued to provide fish rearing habitat, with arctic grayling, lake trout, brook stickleback, burbot and spoonhead sculpin collected. Pond inlet depths were maintained. No arctic grayling spawning was observed at Stream B in June, but an egg count survey was completed upstream, within and downstream of the ford. The majority (> 90%) of eggs observed was from longnose sucker; arctic grayling eggs found were assumed to be from spawning

in the upstream enhancement site. All debris removal sites on Matthews Lake and Sandy Lake were visited in August and mirrored natural conditions.

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Licence Number: 14339
Location: Fox Holes Lakes (60°03' N, 112°27' W)

Molecular Analysis of Evolutionary Change in Stickleback Populations

The investigator's main goal was to further understand how changes in an animal's DNA can lead to changes in the formation of the bony skeleton. The ninespine stickleback fish at Fox Holes Lakes were a good subject for this study because one set of fins (the pelvic or hind-fins) does not develop properly. During three days in May, sticklebacks were collected at Fox Holes Lakes using wire mesh minnow traps. Ninespine sticklebacks were highly abundant this year and were easily trapped in shoreline vegetation. Water levels in the lakes were noticeably higher this year than last year, although this collecting trip took place earlier than in previous years. Salt levels also differed between lakes, and sticklebacks were more abundant in the water bodies with less salt. In total, 150 ninespine sticklebacks were collected, most of which were in breeding condition (females were full of eggs; males had black breeding coloration on their bellies). Brook sticklebacks were comparatively rare, and only a few were collected. The collected fish are currently still being used in genetics experiments to find the genes responsible for skeletal changes.

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Licence Number: 14415
Location: MacKay Lake and Great Slave Lake

Iodine Transfer to Aquatic Biota

Iodine-129 is a prominent radionuclide for disposal of high level nuclear fuel waste. Despite its importance, transfer data for iodine are scarce because the radioactive isotopes (125I, 129I and 131I) are difficult to use and the stable element has been difficult to measure at environmentally relevant concentrations. Using a new method, it is now possible to measure stable iodine in both substrate and recipient media in order to calculate transfer factors (the ratio of flesh/water concentrations). The intent of this work was to augment the data for key transfer factors in three food chain systems – aquatic, agricultural and terrestrial hunter/gatherer.

In order to give a broader interpretation for the fish samples collected previously, the researcher obtained water and fish samples from a tundra setting out of a fishing lodge on Mackay Lake. The results identified that MacKay Lake is not unique with respect to iodine transfer from water to fish. No further sampling of fish is planned.

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File Number: 12 402 605
Region(s): DC

Licence Number: 14382
Location: Prairie Creek and its tributaries; Harrison Creek and its tributaries; and Sundog Creek and its tributaries

Canadian Zinc - Prairie Creek Access Road Fisheries Studies

The objectives of this research was to confirm the presence or absence of fish habitat at stream crossings associated with the Prairie Creek Winter Access Road alignment and to document present fish habitat characteristics. Biologists supported by Canadian Zinc mine staff completed field investigations at and near the Prairie Creek mine and

conducted fish sampling in Sundog Creek (61° 49' 00" N, 124° 14' 06" W) to determine presence/absence and fish habitat assessment in Prairie, Casket, Harrison, Funeral and Sundog Creeks.

The lower part of Sundog Creek is fish bearing. Numerous arctic grayling (*Thymallus arcticus*) were captured or observed and a suspected bull trout (*Salvelinus confluentus*) was also observed. Fish access to the upper reaches of the watershed is limited by a set of waterfalls and cascades. The upper portion of the Sundog Creek watershed, above the falls, appears to be non-fish bearing.

Prairie Creek fish habitat consists of long sections of shallow run habitat separated by riffles where water depth was generally 30 cm in reaches accessible from the winter road. Deep- water habitat is limited. Casket Creek has a short low gradient reach in an alluvial outwash fan on the Prairie Creek floodplain and upstream the valley narrows and gradient increases. At the time of survey the creek was limited to a 1.5m wetted width and less than 20cm depth. Harrison Creek habitat, near its confluence with Prairie Creek, has been modified due to historic mine development in the 1980's with extensive gabion reinforcement of banks and stream bed.

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File Number: 12 402 792
Region(s): GW

Licence Number: 14364

Location: Specific sampling locations identified by the fish monitor and the local Renewable Resource Councils, in the Gwich'in Settlement Area.

Loche Liver Study

Burbot (*Lota lota*), also locally known as Loche, are considered an important subsistence fish for the Gwich'in people. Concerns regarding liver quality in association with liver appearance were initially brought up, and studied, in the 1980's. This is the second year of a two year study investigating the occurrence of abnormal loche livers in the Gwich'in Settlement Area. The 2007 study concentrated on biological characteristics, contaminants and stable isotopes linked to appearance. In 2008, the emphasis was expanded to stomach analysis, parasite analysis in livers, and genetic subspecies identification, in addition to biological characteristics which will all be associated to liver appearance, where possible.

Loche were collected during November and December 2008 by local fish monitors at traditional fishing locations near the communities of Inuvik, Aklavik, Tsiigehtchic and Fort McPherson. A total of 256 fish were sampled. The following samples were collected from each fish; fork length, round weight, liver weight, liver photograph, stomach weight, sex, maturity and gonad weight. In addition, otoliths were collected for age identification and fin clips for genetics. A local elder was hired to review all the liver photographs and categorize them by appearance. The results of this study should be available by fall or winter 2009.

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Licence Number: 14324

Location: Yellowknife Bay, Great Slave Lake

Shortjaw Cisco Survey in Yellowknife Bay

During the 2008 field season, preliminary work was done on cisco diversity in Yellowknife Bay and Great Slave Lake. The objectives of this study were twofold: 1) to provide a preliminary assessment of cisco diversity in the Yellowknife Bay region of Great Slave Lake; and 2) to provide a preliminary description of the variation among cisco morphs. To satisfy these objectives the researcher used two different approaches. First, fish were grouped into taxonomic units using traditional methods (i.e., visual and basic statistical assessment of key characteristics). Second, phenotypic variation was put into groups using geometric morphometric analyses.

A total of seven sampling trips were conducted at three different lacustrine sites and three sampling trips at one riverine site in Yellowknife Bay. As well, eight sampling trips were conducted at two lacustrine sites and one sampling trip at one riverine site in the east arm.

Ciscoes were captured at all depths and sites sampled, however community composition differed by basin and site. A total of 525 ciscoes and 33 non-ciscoes were collected and sampled during fall 2008. In Yellowknife Bay and the east arm, 313 and 212 ciscoes were captured and processed, respectively. Cisco diversity was greater in Yellowknife Bay in comparison to the east arm.

As this is an ongoing study with funding for 2009, a final report and summary will be provided in late 2009.

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Region(s): NS

Location: Various locations within the EKATI mineral land claim boundary

2008 Aquatic Monitoring Program

The main objectives of the 2008 work were to assess post-baseline conditions in the lakes and streams near EKATI mine activity. Two-thousand and eight marked the eleventh year of post-baseline data collection in the Koala Watershed, the tenth year of monitoring the fish populations of the Panda Diversion Channel and the eighth year of post-baseline data collected in the King-Cujo Watershed. Monitored parameters for all areas included some or all of the following: meteorology, hydrology, water quality, physical limnology, phytoplankton, zooplankton, benthos, fish habitat and fish communities (physical characteristics and tissue sampling).

As a follow up to the 2007 Aquatic Effects Monitoring Program, a study of fish populations in the Long Lake Containment Facility and its receiving water body (Leslie Lake) was also conducted. Data from this study will be compared to data collected from fish populations in natural reference lakes, and will aid in the interpretation of 2007 Aquatic Effects Monitoring Program results.

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Licence Number: 14369

Region(s): IN

Location: Several sump sites in the Mackenzie Delta

Vegetation Recovery at 30 year old Oil and Gas Drilling Sumps in the Mackenzie Delta, NWT

In the summer, research was conducted on 30 year old oil/gas drilling sites in the outer Mackenzie Delta. On these sites the drilling waste was disposed of in sumps, which were capped after the well was decommissioned, leaving a large mound on the well-site. Some of the sumps on these sites were seeded and fertilized and some were left for natural recovery. This research investigated the long-term impact of drilling by comparing the plant community on the sumps to the surrounding undisturbed tundra. It also compared the plant communities on seeded/fertilized sites to the sites that were left for natural recovery. The research was conducted by identifying plant species present on the sites, as well as measuring environmental factors that may affect plant establishment such as elevation, depth of thaw and soil salinity. The preliminary results of this research indicate that the plant communities are different on the sumps compared to the undisturbed tundra in both seeded and unseeded sites. Introduced and seeded grass species were found on the sumps in both seeded and unseeded sites including meadow foxtail (*Alopecurus pratense*), red fescue (*Festuca rubra*) and kentucky bluegrass (*Poa pratensis*). Thirty years after drilling, plant communities on the sumps have not recovered to the state of the undisturbed tundra.



Photo Credit: Ashley Mercer, ARI

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Contaminants

File Number: 12 402 773
Region(s): IN

Licence Number: 14357
Location: Hendrickson Island (69.N, 134.W)

Linking Neurochemistry to Contaminant Exposure in Belugas of the Mackenzie Delta

The objectives of this study were to collect brain and blood samples from beluga whales harvested in the ISR for contaminant and brain analyses. Brain tissue was collected from 22 adult whales (4 females and 18 males) and one fetus to study whether current levels of mercury in belugas can be linked to subtle changes in their brains.

To date, mercury levels have been measured in brain samples. The mercury levels ranged from 0.04 to 20.7 ppm and were mostly in the inorganic form (approximately 60%). The concentration of mercury in the brain was strongly correlated to the concentration of mercury in the liver, which means that the levels of mercury in the brain can be estimated when the levels in the liver are known. Laboratory analyses were carried out in the summer and fall to see if there were noticeable differences in the brains of whales with higher levels of mercury compared to those with lower levels.

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File Number: 12 402 773
Region(s): IN

Licence Number: 14350
Location: Inuvialuit Settlement Region

Assessment of Contaminant and Dietary Nutrient Interactions in the Inuit Health Survey: Nunavut, Inuvialuit, Nunatsiavut

This project sought to incorporate contaminants research within the context of a broader health research study as part of the Inuit Health Survey. The Inuit Health Survey team travelled to four coastal Inuvialuit communities, six communities in the Kitikmeot Region of Nunavut and five communities in Nunatsiavut aboard the CCGS Amundsen. There were 395 ship based participants with a total of 280 blood samples collected for contaminant and biomarker analysis in the Inuvialuit region, 577 participants with a total of 220 blood samples collected in Kitikmeot and 309 participants 263 blood samples collected in Nunatsiavut. A separate land team completed the land-based surveys in Inuvik, Aklavik and Baker Lake during this time period, as well with a total of 332 participants with 264 blood samples

collected. Detailed health, dietary and lifestyle questionnaires were also completed, as well as bone density measurements in women over forty years of age and carotid artery ultrasounds in men and women over forty years of age.

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File Number: 12 402 503

Region(s): IN

Licence Number: 14374

Location: Various lakes in the Inuvialuit Settlement Region

Biological Studies of Waters along the Proposed Mackenzie Gas Project Pipeline Route - Inuvialuit Settlement Region

No research was conducted under this NWT Scientific Research Licence.

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File Number: 12 402 503

Region(s): DC, SS

Licence Number: 14365

Location: Various locations within Great Slave Lake, Stark Lake and Trout Lake

Spatial and Long-Term Trends in Persistent Organic Contaminants and Metals in Lake Trout and Burbot from the Northwest Territories

This study was a continuous investigation of contaminant trends in lake trout caught from the Lutselk'e area (East Arm) and Hay River area (West Basin) and burbot from the Fort Resolution area (near the Slave River outflow) of Great Slave Lake. Organic contaminant concentrations remained low with some, such as HCH and DDT, which seemed to occur in lower concentrations in recent years while mercury concentrations seemed to be increasing. These time trends seem to be associated with variations in the fat content, age and feeding behavior of the fish. In 2008, lake trout and burbot were successfully captured from the target locations. This study allowed for examination of mercury concentrations in lake trout from two additional lakes per year. In 2008, lake trout was provided from Trout Lake and Stark Lake which were last studied in 2003. These findings contributed to Canada's assessment of the effectiveness of national and international programs in reducing contaminant transport to Canada's north. They also contributed to the investigation of the potential impacts of climatic variability on contaminant transport and uptake pathways.

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File Number: 12 402 810

Region(s): IN

Licence Number: 14376

Location: Muskox Mines Syndicate Camp, Muskox Mines Syndicate Landing Strip, Grandroy Camp, Exploration Camp, Western Mining Company Camp

Muskox Mine and Grandroy Mine Exploration Areas - Environmental Site Assessments

No research was conducted under this NWT Scientific Research Licence.

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Licence Number: 14419

Location: BAR-C - Tununuk

BAR-C - Tununuk - Environmental Site Assessment

This environmental site assessment's goal was to determine nature and extent of any residual risks to human health or the environment and to provide any remedial action to mitigate the identified risks. The project team completed a detailed historical review, interviewed previous site personnel and local residents, and conducted an extensive environmental sampling program to achieve this goal.

The assessment provided the following preliminary details of site conditions:

- 14,000 m³ petroleum hydrocarbon impacted soils
- 3,500 m³ metal impacted soils
- <10 m³ PCB impacted soils
- 4 existing landfills
- 700 m³ non-hazardous wastes
- 20 m³ hazardous wastes (PCB & lead painted materials, asbestos, etc.)
- Historic airstrip (unusable condition)
- All site access roads / routes require extensive repair
- Dock / Barge Landing in serviceable condition

Indian and Northern Affairs Canada and Imperial Oil Limited plan to complete a supplementary sampling program during the summer of 2009 to answer questions resulting from the 2008 assessment.

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File Number: 12 402 778

Region(s): SA

Licence Number: 14363

Location: Four abandoned mine sites: Silver Bear Mine, El Bonanza, Port Radium and Contact Lake

Contaminated Sites Field Sampling Follow-up - Great Bear Lake Sites

As part of the environmental commitment of Indian and Northern Affairs Canada, researchers were commissioned to monitor and assess the environmental impacts and risks of several abandoned mines within the Echo Bay Region of Great Bear Lake. Two projects were completed during the 2008 field season: long-term monitoring of the Port Radium Mine (post-remediation), and continued assessment of the Great Bear Lake mines Contact Lake, El Bonanza and Silver Bear (pre-remediation).

The 2008 Port Radium long-term monitoring plan was conducted in two stages: a spring inspection of the work done during remediation, and a fall field campaign to measure levels of gamma radiation, determine water quality and further monitor the structures built during remediation (e.g., mine caps). Results of the Port Radium 2008 environmental monitoring were compared with results from previous years at the site. The work completed during remediation was seen to be performing as planned, with the structures in generally good condition. Gamma radiation and water quality measurements were in most cases similar to natural background levels, and consistent with previous evaluations.

Work at the Contact Lake and El Bonanza mines focused on the collection of water, vegetation, soil and sediment samples to supplement the results of previous field programs. Sampling at Silver Bear Mine properties concentrated on the sampling of suspected Contaminants of Potential Concern. While some environmental impacts were noted on the mine sites, there were minimal effects on the surrounding land and water systems. The results of the 2008 field program, in combination with previous reports, have been used to assist with the final design of remedial strategies for the sites.

All samples were collected manually and with minimal impact to the environment. The field programs were conducted with environmental, technical and logistical support provided by members of the community of Déline.



Photo Credit: William Hurst, ARI

Engineering

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File Number: 12 402 815

Region(s): IN

Licence Number: 14404

Location: North of Tuktoyaktuk Peninsula, near Herschel Island and at the EL 446 (Ajurak) lease site

Ajurak Bioacoustics Bowhead Whale Research Program

The primary objective of this project was to collect and analyze acoustic data using two arrays of underwater recording units deployed in the Canadian sector of the Beaufort Sea, with a particular focus on bowhead whales (*Balaena mysticetus*) during the late summer and early fall of 2008.

The arrays were placed over the Ajurak (EL 446) licence and over an area off the Tuktoyaktuk peninsula known to be used for feeding by bowhead whales

Overall, the field effort resulted in two very good acoustic data sets. Throughout the deployment period, 17 of the 18 units operated as expected.

The preliminary analysis of the data revealed a high proportion of bowhead whale sounds on the control array and relatively fewer on the Ajurak array. In many cases, the same bowhead call was recorded on three or more different units. Thus, location analysis is expected to provide data for tracking and estimating the minimum numbers of whales, and the direction and speed of travel for calling animals within and around an array area. This work is ongoing.

As expected, the Ajurak array also recorded seismic air gun activity. Therefore, a detailed comparison of the seismic and biological sounds from the two array areas is likely to yield important insights into the relative number of bowhead whales and the amount of seismic sound exposure for individual animals in the two areas.

In summary, the field project was successful, and ongoing in-depth analysis of the data collected is expected to yield valuable information.

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File Number: 12 402 814

Region(s): IN

Licence Number: 14403

Location: Various locations throughout the Mackenzie Delta

MGM Energy Corp. Summer Field Assessment and Advance Barging and Staging Project: 2008-2011

The objective of this research was to identify and document valued vegetation components in the vicinity of proposed winter activities. Each selected site will be assessed for important vegetation components, such as the potential for rare plants and vegetation communities. The research included photo documentation and visual observations to characterize each site for vegetation features. Information collected during the study was used in planning and determining appropriate locations for 2008/2009 drilling and seismic activity components.

This research will be completed to investigate potential winter drill and seismic project sites. Selected sites identified during the earlier reconnaissance include: potential barge landing and staging sites; potential component activity sites within exploration areas; potential overland access routes for the projects. A helicopter-supported field survey was conducted, including ground times of approximately four hours at each selected site.

Traditional knowledge was incorporated into the research to the extent possible. The Inuvialuit Cultural Resource Center was consulted to obtain information on heritage sites and traditional land use. A wildlife monitor familiar with the assessment areas accompanied all field crews to provide traditional land use information.

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File Number: 12 406 050
Region(s): SS

Licence Number: 14334
Location: Nonacho Lake

Nonacho Lake Investigations for the Taltson Expansion Project

The objectives of the surveys were to document locations of snowmobile travel routes, record snow depth, ice thickness, presence of overflow and presence of hanging ice and thickness of air pocket if present. An aerial survey of Nonacho Lake was performed to look for signs of recent human activity and wildlife. The entire area of the lake was flown in a zigzag pattern covering all major inlets and bays with an Aviat Husky airplane. Special attention was given to areas where local trails lead into and out of Nonacho Lake. The crew that conducted this survey included local community members.

Signs of human activity would have been easily detected during the survey as the daylight and spring snow conditions were ideal. The snow had settled, making all tracks placed throughout the winter obvious. However, observer did not see any signs of human use and confidently concluded that no one had visited Nonacho Lake during the past winter. Absence of human activity is likely related to caribou. Caribou were close to Łutselk'e this year, so residents did not need to travel to Nonacho Lake to hunt. As well, local trap lines do not extend as far as Nonacho Lake. Caribou and caribou tracks were observed at Nonacho Lake, but no other signs of wildlife, including beaver lodges and muskrat push-ups, could be seen through the snow.

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File Number: 12 406 049
Region(s): SA

Licence Number: 14331
Location: Within the municipal boundary of Norman Wells

Wind Energy Monitoring in Norman Wells

The objective of this wind monitoring study is to quantify the wind energy potential for the economic feasibility of building a wind farm near Norman Wells. A forty meter wind monitoring station was installed on Kee Scarp. This wind monitoring tower has five wind monitoring sensors (anemometers) positioned at the following heights above ground 10m, 20m 30m and two at 40m. The anemometers measure both wind speed and direction to estimate the wind energy potential at the monitoring site. All of the data is downloaded monthly by the community wind monitor who maintains the wind monitoring site and equipment. This project will continue to monitor wind speeds for a period of two years at which time the data will be analyzed and the wind tower removed.

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File Number: 12 406 049**Licence Number:** 14344**Region(s):** IN**Location:** Wind tower site at Tuktoyaktuk**Wind Energy Monitoring in Tuktoyaktuk, NWT**

The objective of this study has been to quantify wind energy potential and determine the economic feasibility of building a wind farm in Tuktoyaktuk. This year, wind data continued to be collected and analyzed. A technical report was prepared for the community providing an update of activities and ongoing data analysis. A plain language summary report was also prepared for the community, providing an overview of the project, a summary of the findings and wind estimates at the proposed wind farm site. The 10-year average wind speed at the current wind monitoring site is estimated to be 5.35 m/s at 37 meters above ground level. A computer wind flow model calibrated to the wind monitoring station estimates that the long-term mean wind speed at the proposed wind park location will range from 5.3 to 5.4 m/s at 37 meters above ground level. These wind speeds are considered suitable for proceeding with wind development in this region. The two reports have been made available to Tuktoyaktuk community organizations and other interested parties both in print and online.



Photo Credit: ARI

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File Number: 12 408 151

Region(s): NS

Licence Number: 14288

Location: Yellowknife (and outside the NWT)

Should Newborn Screening be Initiated in the Northwest Territories for Mild Carnitine Palmitoyl Transferase-1 Deficiency?

The goals of this proposed study were: 1) to determine how common a particular genetic change, known as the P479L variant, is in NWT; 2) To determine whether the P479L variant is associated with an increased risk for infant death; and 3) to share results with the Medical Officers of Health and appropriate community and public health representatives in NWT to determine whether newborn screening for the P479L variant and/or public health measures are needed in NWT in order to help prevent infant deaths. The 2006 newborn bloodspot cards for the Northwest Territories were stored in Edmonton and were pulled and genotyped for the P479L variant of Palmitoyl Transferase-1. The resulting data were analysed in Victoria. Results from the analysis were anonymous, and data for the territory was reported back as total numbers.

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File Number: 12 408 161

Region(s): IN, GW, SA, NS

Licence Number: 14437

Location: Stanton Territorial Hospital and Inuvik Hospital

Surveillance and Cost Analysis of Respiratory Syncytial Virus Infections in Arctic Communities in Canada

The Northern Respiratory Syncytial Virus surveillance sites included Stanton Regional Hospital and Inuvik, as well as three other sites in Arctic Canada and four children's hospital in the south, and multiple sites in Greenland. Although the study went well, there were challenges in coordinating numerous sites. As with multiple sites, there were some delays in getting the data forms. A total of 134 children were screened for eligibility from the Canadian sites, with 79 children enrolled in Canada, of which 27 were enrolled from Stanton Regional Hospital. The data from Inuvik has not yet arrived. From the 43 children that results have been collected for, 13 are Respiratory Syncytial Virus positive, 18 are Respiratory Syncytial Virus negative and 12 are unknown. All children had further testing for the viruses. As the study continues to enroll children, there will be more detailed information about the admissions and more detailed viral testing.

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File Number: 12 408 146

Region(s): IN

Licence Number: 14287

Location: Inuvik, Tuktoyaktuk and Ulukhaktok

Healthy Foods North Intervention Project

This multi-phased project began October 2006 with a goal of promoting healthy food consumption and activity through education and improved availability, and to prevent chronic disease. In 2008, Healthy Foods North continued to implement additional intervention phases in order to promote healthy eating and active living in the communities of Inuvik and Tuktoyaktuk. Additional data gathering components were also completed in 2008:

- Heights, weights and physical activity information (using the seven question version of the International Physical Activity Questionnaire) involving approximately eighty participants.
- 24-hour food recalls (repeated up to three times during a seven day period) for validation of the Qualitative Food Frequency Questionnaires that were used in 2007. Approximately fifty people in Tuktoyaktuk were interviewed.
- Qualitative Food Frequency Questionnaires and Adult Impact Questionnaires were completed in Ulukhaktok.
- Process evaluation of program intervention activities continues to be documented.

Anthropometric measures were required as part of the pre/post intervention assessment. Local community data collectors, working with Canadian University students, were trained to conduct this data collection. Results were communicated to residents on an on-going basis through local Hamlets and other local and regional organizations.

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File Number: 12 408 157

Region(s): IN

Licence Number: 14388

Location: Holman, Paulatuk, Sachs Harbour, Tuktoyaktuk, Inuvik and Aklavik

The Inuit Health Survey: Health in Transition and Resiliency

The Inuit Health Survey was developed to better understand the factors contributing to Inuit health. Inuit want health information and health research that is of practical relevance so that informed decisions can help minimize the negative consequences of the rapid transitions that continue to occur in Arctic communities.

The Canadian Coast Guard Ship Amundsen traveled to Tuktoyaktuk, Sachs Harbour, Paulatuk and participants were given an appointment onboard the ship where they met with nurses and interviewers. Blood samples were collected, and blood pressure, pulse, height and weight were measured, and men and women over forty years of age had additional specialty tests performed. Participants then met with interviewers and answered questions about general health and well-being, tobacco use, diet, physical activity and social support. A team of laboratory technicians prepared all blood samples for analyses. Also, a separate research team went to Inuvik and conducted the health survey at the Inuvik Hospital for participants of Aklavik and Inuvik.

Two hundred ninety-one participants were seen from the Inuvialuit Settlement Region, either on board the ship or in Inuvik. Results letters were mailed to each participant and local health centers for follow-up where needed.

Data entry and data checking has been completed. Results workshops with the steering committee were planned to help in developing the reports that go back to Inuvialuit Settlement Region communities.

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File Number: 12 408 149

Region(s): IN, GW

Licence Number: 14269

Location: Aklavik

The Aklavik *H. pylori* Project

The Aklavik *H. pylori* Project was conducted with guidance from the Aklavik Health Committee with the long-term objectives of this research being to develop a comprehensive approach to investigating community health problems related to *Helicobacter pylori* infection in NWT communities and to identify public health solutions that respond to community health care needs as perceived by community members and health authorities. Since November 2007, 368 participants have enrolled, 339 have completed a clinical survey, 313 had a breath test for *H. pylori* infection and 58% of those tested were positive. In February 2008, 194 completed a scope test and had stomach biopsies taken. The doctors who did the scope tests observed that 3% had stomach ulcers, 14% had inflammation in the stomach and 10% had inflammation in the esophagus. The pathologist who examined the biopsies observed that 67% had *H. pylori*, and among those with *H. pylori*, 43% had severe inflammation and 20% had damaged glands (atrophy). This level of severe inflammation of the stomach is much higher than that observed in Edmonton. The prevalence of *H. pylori* infection is higher among those who had a scope test because participants who had positive breath test results were more likely to have the scope test. Since April 2008, 167 participants and 94 households have completed epidemiology surveys. In November and December 2008, 111 participants with *H. pylori* infection enrolled in a treatment trial and 80 had a breath test after treatment to see if the treatment worked.

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Region(s): NS, SS, GW, IN, DC

Licence Number: 14407

Location: Members of the Association of Social Workers of Northern Canada who practice throughout the Northwest Territories

Subjective Well Being and Social Workers within a Canadian Northern Context

The purpose of this study was to collect information about the subjective well-being of professional social workers through a questionnaire from approximately 140 registered, professional social workers in the Northwest Territories and northwestern Ontario.

Subjective well-being was an idea born out of the social sciences that represented how one evaluates his/her life and includes measures of life satisfaction, a lack of depression and anxiety and positive moods and emotions. The goal of this research was to identify workplace factors that predict the subjective well-being of practitioners and to shed insight into ways in which the field of social work can be restructured in order to develop exemplary workplace practices that support subjective well-being and to encourage the development of social worker strengths and capacities. Of the research participants from the Northwest Territories, 43 survey instruments were returned (representing a response rate of 71.7%). Of those 43 instruments, 8 were returned blank for various reasons and one practitioner only returned a partial survey. As a result, of the returned survey instruments, only 32 were usable and included in the analysis (representing a response rate of 53.3%). The data is currently being analyzed and will be distributed once this analysis is complete.

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Region(s): IN, GW

Licence Number: 14309

Location: Aklavik and Ulukhaktok

Changing the "Culture of Smoking": Community-Based Participatory Research to Empower Inuvialuit Communities

This community-based participatory research project began in Aklavik and Ulukhaktok in the fall of 2007.

In late 2007 and early 2008, tobacco use baseline surveys for youth (aged fourteen and under) and adults were developed with input from local teams and other partners. Team members completed the surveys in late 2008, with a total of 201 surveys from both communities: 69 from Aklavik (46 adult; 23 youth) and 132 (all adult, no youth) from Ulukhaktok.

From November 2008, both communities participated in a major community-based tobacco reduction intervention, called the "(Stay) Quit to Win Challenge". A total of three hundred 24 people (208 adults; 116 youth) participated, promising to remain smoke-free for six weeks.

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File Number: 12 408 156

Region(s): NS

Licence Number: 14347

Location: Stanton Territory Health Authority, Yellowknife

Determining the Attitudes of Women and Maternity Care Providers Toward Birth: Conflict, Confusion and Concordance

The rate of cesarean section in Canada is approximately 30%, even though vaginal birth is known to be safer. What pregnant women and those who care for them believe about birth, and their childbirth options, can conflict with scientific evidence about how to achieve a healthy birth. This highlights opportunities to intervene to reduce cesarean section use where it is not medically needed.

This national study had already surveyed 2,600 obstetricians, midwives, family doctors, nurses and doulas. Women across Canada approaching their first birth were invited to complete a survey. We reached them by using colour posters and bilingual bookmarks. The survey was available online or in paper form by request through a toll-free number.

More than 1100 pregnant women have filled out surveys. Twenty women were from the 3 Canadian territories; 5 from the Northwest Territories.

The analysis of the surveys aimed to discover how pregnant women develop their beliefs about childbirth and their level of understanding about childbirth options. This information aided in understanding how to prevent unnecessary interventions in childbirth and promote normal vaginal birth.

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File Number: 12 408 153

Region(s): IN, GW

Licence Number: 14286

Location: Beaufort-Delta region

Negotiating Change: Community-based Mental Health and Addictions Practice in the Northwest Territories

The purpose of this research was to explore how the work of community-based mental health and addiction counselors and wellness workers is changing and identify some ways this work can be supported.

In total, 15 counselors and wellness workers who served 8 different Northwest Territories communities participated in this study. Their insights and reflections suggested that substance use continues to be a struggle in many communities. Alcohol remained the substance of primary concern with increases in marijuana use in smaller communities and crack cocaine in larger centers.

Practitioners spoke of decreased stigma surrounding disclosure of abuse and many people utilizing counseling to address these issues. The impacts of changes to the way mental health and addiction services are organized and delivered in communities was a key topic of discussion. The need for choice in counseling and treatment options was

identified as important by practitioners, with a specific focus on the need for the development of local, culturally-appropriate services. This included the specific recommendation for a healing program specifically addressing trauma.

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File Number: 12 408 159
Region(s): NS

Licence Number: 14420
Location: Yellowknife

Understanding the Self-perceived Barriers and Facilitators to Positive, Empowered and Safer Sexuality among Young Women in the Northwest Territories

Compared to other Canadian youth, young people in the Northwest Territories suffer disproportionately from more negative sexual health outcomes, such as high rates of Sexually Transmitted Infections and adolescent pregnancy. Although numerous quantitative studies measure indicators of sexual health amongst Northwest Territories youth, little qualitative research explores the barriers and facilitators that impede or support their ability to achieve positive, empowered, or safer sexual health outcomes. The purpose of this study was to explore the self-perceived barriers and facilitators that impact female youth in the Northwest Territories, as this demographic has one of the highest vulnerabilities for Sexually Transmitted Infections and unintended pregnancies and represents the fastest growing population for HIV/AIDS transmission in Canada. Recruited through purposive sampling, twelve female participants aged fifteen to nineteen who live in the Northwest Territories and mostly or always have relationships with male partners participated in audio taped, semi-structured, face-to-face interviews that followed a constructivist framework. Using qualitative data analysis software, inductive coding and thematic analysis of transcribed data occurred. Results of this research increased understanding of the self-perceived barriers and facilitators to positive sexual health for young women in the Northwest Territories, thus, potentially aiding in the development of appropriate and effective health promotion initiatives and programs for this population.

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Licence Number: 14433
Location: Tuktoyaktuk

Inuit Oral Health Survey

The objective of this research was to establish the oral health status of the average Inuk, as compared to the oral health status of the average Canadian. The oral health status was measured through two components: a self-reported interview and a dental assessment.

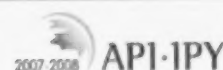
A survey team, consisting of two dentists and a clinical coordinator, conducted the research in Tuktoyaktuk. This was one of the six Inuit communities selected from three different Inuit regions: Inuvialuit, Nunatsiavut and Nunavut. Community people were hired to conduct the interviews and record the results from the dentist's oral health assessment. Two hundred volunteers aged three and up, participated.

Some of the questions participants were asked concerned to how satisfied they were with the appearance of their teeth, if they had tooth or gum pain, and whether or not they had access to dental care. Following the dental assessment, the dentist discussed the findings with the participant.

The collection of information on a national level was completed. The information was analyzed and will be released in a report published in the spring of 2010. Research results will be used by the Federal and Territorial governments and by policy makers, to enhance or create preventive health and dental programs.

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File Number: 12 408 154

Region(s): NS, SS, DC, SA, GW, IN

Licence Number: 14335

Location: All community health centres, medical clinics and hospitals within the Northwest Territories

The Prevalence of Human Papillomavirus and Its Impact to Cervical Dysplasia in the Northwest Territories

Human Papillomavirus is a sexually transmitted virus. There are many different types of human papillomavirus and some cause cervical cancer. The primary objective of this study is to determine the prevalence of the Human Papillomavirus infection and cervical dysplasia in women of the Northwest Territories using a DNA technology (HPV-DNA Test). The study will also aim to determine whether cervical cancer screening programs should include the use of the HPV-DNA test to increase effectiveness of cervical cancer screening. This project was done to find out the overall burden of human papillomavirus and will improve screening for cancer of the cervix.

The project was implemented in two distinct components. Component I, from April 1, 2008 to March 31, 2009, Pap test samples taken from Northwest Territories women were tested anonymously. The purpose of Component I was to understand how many women are infected by human papillomavirus and of which type. Component II, will run January 1, 2009 to September 30, 2009, nurses, midwives and doctors will ask women from selected communities to participate in the study by signing a consent form, completing a questionnaire and having a Pap test. All the information collected will be handled in a confidential way. The purpose of Component II is to find out the risk factors of human papillomavirus infection and its impact on cervical cancer.

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Region(s): NS

Licence Number: 14338

Location: Behchokq, Gamèti, Wekweèti and Whati

Tłichq Natsedzi Nihtsi: Tłichq Healing Wind Project/ Promoting Sexual Health

The research-to-action program has been developed based on the community-based sexually transmitted infections survey completed in early 2006. The goal was to communicate the research results to the youth, the highest risk group in the research findings, in classrooms talks and public meetings. The research team met with the Board of the Tłichq Community Services Agency and also with the Tłichq Governing council regarding the need for sexually transmitted infection prevention, and gained full support. A three-day Youth Assembly brought together young people from the four Tłichq regional communities; one day was spent educating the youth about sexually transmitted infection prevention. Funds were attracted from the Canadian Institutes of Health Research and several contribution agreements for continuing research activities, including focus group sessions with hard-to-reach youth. In order to increase research-to-action activities the Tłichq Community Services Agency recruited five full-time personnel, all between twenty-eight and thirty-two years of age, and trained them to conduct a full range of community-based research activities, and to become skilled in communicating the results to all community sectors, through a range of media, including the Internet. These activities were measured over the winter with another community-wide survey. The hope was that the activities of the new Community Action Research Team will reduce the incidence of sexually transmitted infections in the Tłichq region.

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File Number: 12 408 117

Region(s): NS

Licence Number: 14399

Location: Yellowknife and Fort Smith

Evaluation of Maternal Child Nursing Education in the Northwest Territories

The main goal of this research was to examine the nature of maternal child nursing education in the Northwest Territories. More specifically, the research studied the influences in the territory on maternal child nursing education and what works or does not work to educate nurses for maternal child practice.

Research began for this project in the summer of 2008, and will extend into 2009 and 2010. Maternal child nursing was required in all undergraduate programs, but educators and health care providers worried that clinical experience and theoretical content compete with many other elements of knowledge and practice development. As well, maternal child nursing was considered a specialty of nursing so questions arose about how much clinical experience should occur in the education process and when and where it should occur. Context played a significant part in the placement of nursing students. Fourth generation evaluation (utilizing individual interviews and group meetings within a hermeneutic process) was used with participants from three key stakeholder groups: health care providers, nursing students and nurse educators in an evaluation of maternal child nursing education. Data collection occurred at two settings across the North. Women-centered education from a critical feminist perspective was indicated from the literature and endorsed by the current curriculum. Contextual characteristics required attention to strategies inclusive of these distinctions, including characteristics such as the geographical isolation and remoteness, as well as the diverse population. Maternal child nursing education in the Northwest Territories was reflective of the contextual realities, a health care system entrenched in colonialism, women's health indicators, competencies and standards required and the learning needs of health professionals within the system. Inequities for parturient women in the North highlight the need for social justice practices.

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File Number: 12 408 117

Region(s): NS

Licence Number: 14431

Location: Yellowknife Campus, Aurora College

Formative Evaluation Study of the BSN Program of the Collaboration for Academic Education in Nursing

The purpose of this study is to evaluate the revised nursing curriculum being used at Aurora College as a partner within Collaboration for Academic Education in Nursing.

Aurora College, as a partner within the Collaboration for Academic Education in Nursing, was engaged in a multiyear formative evaluation of the Bachelor of Science in nursing program. There were a variety of techniques used within the two year data collection and analysis process. Focus group meetings have been conducted with a cohort of students across Collaboration for Academic Education in Nursing on completion of year one and year two. This same cohort was interviewed again within the focus group at the completion of year three and four. Aurora College faculty, along with the other Collaboration for Academic Education in Nursing faculty, participated in year focus groups annually at the Collaboration for Academic Education in Nursing conference. Data was collected from year one and year two faculty from all sites. Further, data was collected from each site answering four questions. In response to the preliminary findings, new questions evolved. Findings were favorable for the curriculum revisions and some gaps were identified with recommendations sent to the curriculum committee.

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Region(s): NS

Licence Number: 14401

Location: Yellowknife

Electronic Medical Record Case Studies

The purpose of this research is to provide physicians with practical information on best practices and lessons learned with regards to implementation and use of electronic medical record (EMR) systems in ambulatory clinical practice settings. Researchers interviewed physicians, nurses and office staff in primary care settings in the Northwest Territories. An EMR System and Use survey was sent to multiple primary care clinics across Canada and twenty single-handed, small and large group clinics, including one from Northwest Territories, participated.

These surveys were used to create interview questions; completed onsite during the researchers' visit. One hour interviews with the lead physician, and one hour observations of physician, nurse and office staff interacting with their EMRs were completed.

Research results of EMRs provided decisive evidence to support the benefit to Canadian primary care, resulting from implementation of EMRs. For the report please see: http://www.cma.ca/index.cfm/ci_id/85596/la_id/1.htm.

Clear success factors and specific roadblocks that affect the implementation and use of EMRs were found.

Success Factors

- Need for personal leadership and strong commitment to the EMR
- Funding
- Change management/ability to re-engineer clinic workflow and processes
- Payment model
- Collaborative culture

Roadblocks

- Data entry for patient histories/charts prior to implementation of EMR
- Interoperability
- Maintenance
- Storage
- Technical
- Change management
- Payment model/rostering

Further research was needed to aid in future decisions to minimize financial, social, policy and pragmatic impacts as more EMRs are initiated.

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Region(s): IN, GW

Licence Number: 14438

Location: Inuvik Regional Hospital

Strategies to Enhance the Transference of Knowledge for Employees of a Regional Authority

The objective of this research is to develop a strategy that may improve the prospect of transference of knowledge from senior employees to junior employees within the Beaufort-Delta Health and Social Services Authority (BDHSSA).

The research questions were: 1) How can the BDHSSA improve its potential to effectively and consistently share specialized knowledge with its employees that are new to the organization? 2) What do new employees need when they begin work at the BDHSSA? 3) How does the BDHSSA communicate its corporate knowledge to new employees? 4) How do new employees orient themselves to the mission and culture of the organization? 5) What level of information does the seasoned employee share with newly hired employees of the Authority?

The researcher conducted four individual interviews and one focus group during working hours. Results were submitted to the Authority.

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Region(s): GW, IN, DC, SS, NS,
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Licence Number: 14430

Location: Within the registered nursing population of the Northwest Territories

Phase 2: Strengthening the Quality of Community Health Nursing Practice: A Pan-Canadian Survey of Community Health Nurses' Continuing Education Needs

The objectives of this research were: 1) to identify community health nurses current practice activities and their continuing education needs based on the Community Health Nursing Standards of Practice; and 2) to investigate differences in continuing education needs by:

- i. Workplace setting (e.g. primary care, home health care, public health, family practice);
- ii. Position held by the nurse (e.g. public health nurse, nurse practitioner, home visiting nurse);
- iii. Total number of years of nursing and community health nursing experience;
- iv. Age;
- v. Province/territory.

The Canadian Community Health Nursing Standards of Practice were released in 2003 and updated in 2008 by the Community Health Nurses Association of Canada. There was no research to explore the capacity of community health nurses to meet these standards, with the exception of the Phase I work completed by this research team in early 2008 in Nova Scotia and Ontario. The purpose of the second phase was to expand the survey to identify current practice activities of community health nurses across all Canadian Provinces and Territories and to measure their continuing education needs in relation to the Canadian Community Health Nursing Standards of Practice.

The results from this study revealed a number of important topic areas for continuing education of community health nurses including: a) health promotion theory, b) program evaluation, c) engaging in collaborative intersectoral partnerships, d) principles of epidemiology, e) nursing informatics, f) culturally relevant care, g) harm reduction, h) emergency management, i) addressing service accessibility issues at the federal level and j) advocating for health public policy. Results also indicated that there are some differences by province and territory both in performing nursing activities identified in the Canadian Community Health Nursing Standards of Practice, as well as, learning needs related to them. There were also statistically significant differences by province/territory on many of the questions warranting a need to tailor continuing education programs for certain provinces or territories.

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File Number: 12 408 152

Region(s): NS

Licence Number: 14280

Location: Yellowknife

Introduction of an Aboriginal Wellness Program at Stanton Territorial Health Authority

With over half of the population of the Northwest Territories of Aboriginal descent, it is imperative to structure health programs and services to meet their needs. In this research project, health care professionals and Aboriginal Elders offered their perspectives, experience and knowledge on how to introduce traditional health/healing practices in an acute care setting. Study findings revealed: awareness of differences in beliefs is imperative; need for better understanding of cultural ways and a shift to a holistic approach to treatment is necessary; education and training is required for staff and patients; and traditional practices have a role in the provision of health care. Some recommendations for the foundation of an Aboriginal Wellness Program included: defining wellness in an Aboriginal context; supporting and revitalizing current hospital traditional practices; adopting an organizational cultural development model to lead staff education and training; and developing guidelines and policies for accessing and providing traditional services.



Photo Credit: ARI

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Social Science

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Region(s): NS, SS, DC, IN, GW,
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Licence Number: 14312

Location: Yellowknife, Ray-Edzo, Hay River, Fort Smith and Normal Wells

The Induction Program in the Northwest Territories

The aim of this research was to examine the usefulness of the induction program for beginning and new teachers in the Northwest Territories. "Beginning teachers" referred to those who had recently finished their university degrees and had been recruited as teachers. However, the term "new teachers" referred to experienced ones who were new to the region. The induction program was designed to help new and beginning teachers to adjust to the demands of their new jobs and to the school's environment by providing support and encouragement. Therefore, they were provided with personal-emotional, professional, ecological-organizational and cultural help. The program consists of four phases: pre-orientation, orientation, mentoring and professional development.

The research was quantitative and qualitative. Two questionnaires, one for beginning teachers and the other for the new ones, were developed to examine the usefulness of the induction program and the contribution and support that the newly recruited teachers get in the four stages. These were distributed to new and beginning teachers all over the Northwest Territories.

The questionnaires included three open questions for the aim of evaluating their experience as inductees. In addition, thirty people were interviewed: four administrators, four mentors, twelve beginning teachers and ten new ones. Forty-two teachers out of ninety-seven returned the questionnaires. The quantitative as well as the qualitative results show that the professional development stage was highly valued. In addition, both parts showed that mentoring is essential; however, it should be seriously addressed to meet the needs of the inductees. The results also showed that male and female teachers had similar opinions regarding the induction programs. Differences between the two sexes were not reported. Cultural help should be well provided during orientation.

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Location: Yellowknife

The Effectiveness of the Management Assignment Program in a Government Setting

This research project looked at a government leadership program. Research showed that governments face challenges as the workforce ages. Some of the challenges are: changing demographics, generational differences, workforce diversity, skill gaps, downsizing, high staff turnover and loss of organizational knowledge. To deal with these challenges, governments spent money on leadership development programs. However, in many cases governments did not evaluate the programs in a thorough way. This study used a federal government evaluation framework to see if the program developed leaders and met organizational needs. The research findings suggested that the program was only successful in the first two years. By the third year, the program did not meet the needs of program participants or the organization. A recommendation would be to have a leadership development system in place that employers and employees value and support.

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Location: Tuktoyaktuk

Arctic Gardens: Voices from an Abundant Land

No research was conducted under this NWT Scientific Research Licence.

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File Number: 12 410 617
Region(s): IN, DC, NS

Licence Number: 14278
Location: Inuvik, Fort Providence and Yellowknife

Storying Progress: Documenting Non-Academic Outcomes among Aboriginal Learners

The goal of this study was to examine non-academic outcomes among Aboriginal learners in an effort to reframe notions of success. Researchers travelled to Adult Literacy and Basic Education Programs in three communities. They conducted interviews with 57 adult learners, which were subsequently transcribed. Interviewers returned to the communities to meet with each learner, verify and, if necessary, revise learner stories. Interviewers also interviewed instructors from each program.

Analysis of the information showed that learner perceptions of their achievements included 1) improved personal skills e.g. improved self-confidence; 2) new practical skills e.g. being able to help children with homework; 3) the ability to build better relationships e.g. improved interpersonal skills; and 4) improved readiness for further education and employment e.g. being able to work in teams. Learners also broadened their horizons and had more opportunities. Family and community members often saw learners as role models.

Learner success was contingent on several critical success factors: 1) support from various people; 2) the learning environment; 3) the curriculum; and 4) the funding. The development of a sense of community among learners was integral to the learning process. The challenges each faced were well understood by all and they supported each other to overcome or deal with them.

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Region(s): GW

Licence Number: 14408
Location: Fort McPherson

Dying: Perspectives of a First Nations Community in the Northwest Territories

The experience of facing death can be difficult for the terminally ill patient and their family and friends. This qualitative research project sought to understand how the Gwich'in of Fort McPherson historically perceived death

and dying, and to document their current protocols regarding the same. This project also examined participants' views and experiences regarding end of life care services.

Preferred place of death was another component explored in the study. Ten community members, most of whom were elders were interviewed. Relying on participants' traditional knowledge, perspectives and experiences pertaining to death and dying, the data analysis was identified in three primary categories: 1) historical perspectives and practices, 2) contemporary perspectives and practices and 3) end of life care services experiences and perspectives. Findings included the resilience and importance of traditional values and customs, the importance of traditional food and the value of traditional medicine. Further, culturally relevant end of life care services needed to be developed, as the Gwich'in preferred place of death is at home.

Health and Social Services professionals who work in the realm of end of life care services should have had appropriate cross cultural training, as cultures are diverse. Moreover, it was important for those in the helping field to be aware of how historical and contemporary customs impact the Gwich'in.

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Region(s): IN

Licence Number: 14332

Location: Inuvik and Tuktoyaktuk

Impacts of Climate Change on the Availability of Granular Resources in the Inuvialuit Settlement Region

Physical community infrastructure is vulnerable to changes in permafrost regimes resulting from warming in Arctic environments. The vulnerability of community infrastructure is greatly exacerbated by factors related to the accessibility of aggregates that are used to insulate built form from the active layer of the permafrost. The ability of communities to address stresses brought about by melting permafrost is a function of access to aggregates, the ability to transport them, and competition for gravel between users. In the Inuvialuit Settlement Region readily accessible aggregate is in short supply, and concerns about resource allocation pre-date current prognoses about the impact of global warming. The prospect is that while demand for gravel will increase as permafrost is degraded, competition from new activities along with degradation of winter roads may further stress supplies.

This research project examines the manner in which institutional arrangements, the geography of aggregate distribution, transportation and competition from emerging new activities exacerbate vulnerabilities associated with permafrost melt in the Inuvialuit Settlement Region. It is evident that a granular resources management plan for the ISR is required to mitigate potential community vulnerabilities related to granular resource supply and climate change.

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File Number: 12 410 832

Region(s): NS

Licence Number: 14427

Location: Gamètì, Wekwetì, Behchokò, Whatì and Yellowknife

Transferring Mine Knowledge: a Look at Complex-Value-Based Strategies in the Wek'eezhii Region

In 2008 the Wek'eezhii Land and Water Board worked with the researcher to investigate knowledge-transfer strategies. With help from the Wek'eezhii Renewable Resources Board, the Tlìch'q Lands Protection and numerous Elders and community members in the Wek'eezhii region, a training program on mining was designed for community members and their resource managers. The program was built on the foundation that knowledge-transfer would be most effective when community values and needs dictate the type of information communicated and the process for sharing information. Opportunities to gather data to build a successful program included: interviews, a needs assessment workshop, a pilot training session, a caribou hunt, surveys, a trial training session, a community training session and community events. Ideas and feedback from all of the participants were woven into the program, effectively resulting in a course that catered specifically to the participants that was very much co-designed by the participants. Scientific concepts such as geologic formations and glaciology, along with mineral exploration and processing techniques were described. Emphasis was placed on the created space for enriching topics of discernment by sharing knowledge, perspectives and experiences from all of the participants. This multi-phased project will reach completion in April 2009. A report detailing the activities and findings of the project will be made available in late 2009.

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**File Number:** 12 410 623**Licence Number:** 14210**Region(s):** IN, GW, NS**Location:** Yellowknife, Inuvik and Paulatuk

Homeless in a Homeland: Housing Security, Homelessness and Resource Development in the Northwest Territories

The main objective of this research project was to understand the relationship between housing security/insecurity and homelessness in northern communities. In Inuvik, 25 in-depth interviews, two focus groups with shelter clients, and one collaborative workshop at the Aurora Learning Centre were completed. Research at the Aurora Research Institute and Inuvik Centennial Library was also conducted. Significant collaboration was achieved with various member organizations of the Inuvik Interagency Committee, including the Inuvik Homeless Shelter.

In Yellowknife, twenty-five in-depth interviews, three focus groups with shelter clients and one collaborative workshop at the Aurora College Access Program were completed. Research at the Yellowknife library and Territorial archives was also completed. Significant collaboration was achieved with various member organizations of the Yellowknife Homelessness Coalition.

Key factors for housing security expressed by research participants included self knowledge, cultural connections, home ownership, education and employment, personal safety, healthy relationships and strong social networks. Key factors for housing insecurity included trauma, violence, poor housing quality, inaffordability, dependency, government housing policies, housing shortage and addictions. Links between housing insecurity factors and pathways to homelessness were explored with participants.

Further community-based activities were planned for 2009 to discuss links between housing insecurity and homelessness, and to build creative strategies for promoting housing security.

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File Number: 12 410 814**Licence Number:** 14284**Region(s):** NS**Location:** Wekweëti

Women and Youth of Wekweëti Reveal the Impacts of the Diamond Mines in the Tłı̨ch Region

A multi-method qualitative research design was used to gather interesting and informative research data. Participatory action research and narrative research methods were blended to give texture and meaning to the research and to gain a more intimate understanding of how the community of Wekweëti is being impacted as a result of diamond mines operating in their territory.

Three data collection methods were used in this study; talking circles, semi-structured interviews and field notes in the form of reflexive journaling. Four talking circles occurred and were chosen as a means to generate data. The second way of generating data was through the use of eight semi-structured face-to-face interviews. The personal interviews provided very rich stories that were contextualized by the participants as they revealed personal and intimate information about how the diamond mines have affected their lives. Finally, field notes were used to help reflect and process the issues or problems that cropped up during the research period. Translators assisted in transcribing the data.

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File Number: 12 410 826**Licence Number:** 14379**Region(s):** IN, GW**Location:** Inuvik

Impact of Child Care on Inuvik Labour Market

To explore the impact of child care on the labour market of Inuvik, the employers, human resource departments and managers of Inuvik businesses, industries and government departments were surveyed. The direct correlation between child care and the ability to identify and retain staff and any perceived impacts on the organization was examined. This study was limited to the direct correlation between child care and employment to understand the immediate needs. Therefore, long term impacts such as the relationship between child care and education, training or development of skills for future labour markets, although a potential part of the equation, were not looked at directly. The survey was to gain a perception of attitudes towards child care and measure impacts of child care on the workplace. Seventy-three percent of participants identified child care issues affect their organization. The data matched the predicted outcome that the lack of accessible child care decreases the ability to identify and retain staff. With the lack of staff comes a demonstrated decrease in work productivity and lack of offered services. The general perception is that increased child care services are needed in Inuvik. These results have implications for future policy, program development, infrastructure and funding.

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Region(s): NS

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Location: Yellowknife

Consensus Government in the Northwest Territories

Research was conducted during the winter and spring of 2008 in the Legislative Assembly of the Northwest Territories. The intent was to determine the attitudes of the current Members of that House towards the system of governance styled "consensus", and to determine if that system is an effective and accountable mode of government.

Members were interviewed individually, and were asked to complete an anonymous questionnaire. Questions ranged from procedural matters, potential reform, constituency work, future challenges and general satisfaction with consensus government.

With a participation rate of 89%, the results were conclusive. Members were overwhelmingly in favour of consensus government. The system itself was examined from four major standpoints: accountability, transparency, responsiveness and adaptability. Accountability dealt with the mechanisms consensus government employs to remain accountable to the people of the Northwest Territories. In transparency, the relationship between the Regular Members and the Executive Council was examined, including the communication between the two groups and the influence of the Regular Members in the Legislative Assembly. Responsiveness focused on the manner in which the Legislative Assembly develops policy and how it responds to the needs of Northerners. In adaptability, it was argued that consensus is a derivation of the Westminster parliamentary system.

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Region(s): IN, NS, GW

Licence Number: 14377

Location: Inuvik and Yellowknife

Complexities Surrounding Multijurisdictional Environmental Assessment: Negotiating a Place for Public Participation and Learning

In the thirty years since Justice Thomas Berger first reviewed the Mackenzie Valley Pipeline project, environmental management regimes have undergone significant change. Mega project developments are now subject to environmental assessments, and licensing prior to construction, with the intent to minimize potential negative impacts of development. The purpose of this research was to consider the environmental review of the revised Mackenzie Gas project. Primary data collection included a review of assessment documentation, participant observation during 10 hearings and semi-structured interviews with 31 participants.

Additional data collection was required following the completion of the regulatory process. Results indicated that the hybrid review process designed to address multiple resource management requirements was overly complex, and not fully implemented, resulting in participant uncertainty. Although designed to facilitate public participation, continued extended deadlines and schedules had the unintended consequence of creating barriers to participation and facilitating consultation fatigue. Nonetheless, participants acknowledged that the environmental review had increased understanding about the project, and believed that it would ultimately result in a project that is more ecologically, socially and economically sustainable. Thus, while the process is overly-complex, and confidence faded with time, the review has strengthened project design.

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Region(s): IN, SA, DC

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Location: Fort Good Hope, Fort Simpson, Tuktoyaktuk

Sustainability's Paradox: Petro-Capitalism, Climate Change and Well-Being in Northern Communities: Phase 2

Over the duration of this research, 5 young women were trained in basic social science and video research skills and became the Fort Good Hope Youth Video Research Team. The team carried out interviews around the question guide developed by the youth with community guidance around theme of health, climate change, identity, culture and development for their video series called 'Changes'. The research demonstrated the importance of out-on-the-land activities as an important determinant of health, and the important capacity building potential of video-research for youth. The Youth Video Research Team filmed continual reflections of their experiences and the process of youth research. Climate change was determined to affect health and wellness in the community due to continual dependence on traditional food for wellness and health, high use of on-the-land travel for transportation, community infrastructure and systems are built on previously continuous permafrost which is now melting, weather variability and increasing 'fast changes in weather' lead to increased danger in boating, skidoo and small plane travel. It was also found that increasing oil and gas activity leads to people spending less time on the land as well as decreased harvesting due to climactic factors and exploration leading to decreased cultural teaching and wellness. The video data was analyzed and results will be shared with the community in the form of video, poster and sharing sessions in fall 2009.

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Licence Number: 14359
Location: Fort McPherson, Aklavik, Inuvik and local camps

DEW Line Passage: Tracing the Legacies of Arctic Militarization

This study sought to understand the impacts of cold war military activities in the Western Arctic and how militarization brings about change in small communities. Specifically, the research focused on the history of the Distant Early Warning (DEW) Line and the environmental, economic and cultural impacts it had.

The DEW Line was traveled along and adjacent communities in western Canada and Alaska were accessed by canoe. This method allowed for a better idea of the geographic impact of the radar sites as well as document the ongoing clean up process. Most important, was the knowledge acquired from local residents about what the DEW Line meant to them and what they think about other/future military activity in the Arctic.

Researchers worked with people in Fort McPherson and Aklavik as well as conducted interviews at Shingle Point and Herschel Island.

The project website includes numerous photos and descriptions: <http://www.tundradaisy.org>

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Location: Aklavik, Inuvik, Fort McPherson, Tuktoyaktuk and Yellowknife

Local Attitudes of the Anglican Church Towards its Aboriginal Membership in the Yukon & Northwest Territories

The objective of this project was to see how Aboriginal and non-Aboriginal Christians relate to one another, and assess if attitudes and practices have changed since residential school times. Further research related to if Aboriginal and non-Aboriginal people better understand one another or better recognize their cultural differences through religion.

In 2008, three communities were visited: Inuvik, Fort McPherson and Tuktoyaktuk. 16 people – Anglicans, Roman Catholics and undeclared religions – were interviewed. Of the 16 people interviewed, there were 13 Aboriginal people, two non-Aboriginal people, one person of mixed heritage and one member of the clergy. Informal conversations were held with six others.

There was still a lot of pain and anger about the residential schools but what stood out was how wide the gap between Aboriginal and non-Aboriginal peoples still was. Attitudes common in the residential school period may have been gone, but people did not necessarily know how to interact with one another. For instance, church projects important to non-Aboriginal Christians were not as important to Aboriginal Christians. Initiatives were interpreted differently by the different groups. People of different cultural backgrounds – Gwich'in, Inuvialuit, EuroCanadian – may worship together but they remained worlds apart in many ways.

The interviews from the three trips to the region, the analyses and the recommendations were written and shared with the people and communities involved.

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File Number: 12 410 582
Region(s): NS

Licence Number: 14385
Location: Whati

Swimming Against the Mainstream: The NWT Aquatics Program in Whati

The goal of this research was to document the history of the NWT Aquatics Program in Whati and to expand the understanding of Tlicho practices concerning water. This was being done with the aim of creating both documents and presentations that can decrease water-related fatalities and physical inactivity. The researcher conducted eleven interviews and participant observation within the community of Whati. Through the interviews the researchers learned of several local traditions concerning the water, some stories of past accidents on the water, and the researchers learned a lot about how water safety programming should be changed to better meet the community members' needs. The researchers created a document that was given to the community, which makes suggestions for information that future waterfront staff members might want to include in lessons with community members. This project was part of a four year project and has added information on the connections between colonization and water safety and the need to decolonize water safety education.

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Region(s): DC, NS

Licence Number: 14424

Location: Yellowknife and Hay River

Mobility, Identity and the New Economy: A Multi-site Ethnography

This was a qualitative study about labor mobility and migration among francophone populations in Canada. Rapid economic change was influencing how people thought of who they were and their ways of belonging to communities. This project aimed to understand these changes through the eyes of two groups: 1) those involved in economic planning and development; and 2) those directly involved in training, job-seeking or those who were in the workforce, with a focus on francophones between the ages of 18 and 35 attempting to establish or maintain themselves in the workforce.

This project was a multi-sited project that involved three faculty and five students conducting research in and across various regions of Canada. This project will take a minimum of three years to complete. During this first year fieldwork researchers interviewed various agencies conducting training programs. Specifically, the representatives from the Mine Training Society and Aurora College in Hay River and Yellowknife were spoken with. The training was observed for the "Ready to Work North" program and organized to observe a delivery of the course in 2009. This portion of the work extended the scope of the larger project to include participants who were seeking training or employment but who were not francophone. The goal was to provide an account of how different recruitment and training strategies were targeted to different groups or regions (e.g. Aboriginals, Newfoundlanders, East-coasters, immigrants, women) and described the various strategies used by individuals in their attempts to secure livelihood.

Interviews were conducted in Yellowknife with francophone organizations such as the Councel de Development Economique des Territoires du Nord-Ouest, the Association Franco-Culturelle de Yellowknife and the Federation FrancoTNOise. Meetings and events were attended as observers.

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Location: Yellowknife and Dettah

Morphological Typology and the Athabaskan Verb

This project investigated verbs in the Weledeh dialect of Dogrib, to better understand how different parts of the verb get fused together.

Sometimes, it is easy to pick out the individual parts. For example, *aaht'e* "you are" comes from *a + ah + t'e*; that's why it has a long vowel. If it had a short vowel, *aht'e*, it would be from *a + h + t'e*, meaning "I am". On the other hand, in *hqt'e* "it is," we can still pick out *t'e*, but *hq* can't be broken down into any more parts—it is irregular and needs to be memorized separately.

The researcher worked for five months at the Goyatikq Language Center in Dettah and collected verb forms by interviewing elders. The result was that many verbs that look irregular are the result of sound changes, which improve rhythm and tone pattern. For example, *nawhizé* "we have hunted" comes from *ná + whe + wid + zé*: one of the syllables got deleted because it would have created a bad tone pattern. Knowing these kinds of patterns could help instructors trying to teach the language. The researcher also produced a set of language lessons, in Dogrib and Dene Słliné, for use in language classes at the Goyatikq Language Center.

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Location: Former Pine Point mine/townsite, Fort Resolution, Hay River

Mining and Northern Development: Towards a Historical Political Ecology

This project aims to understand the social and environmental effects of historical mining activities in the NWT. Research in 2008 consisted of establishing primary community contacts, and conducting archival research and field observations related to the history of industrial mining. Communities and organizations contacted regarding their interest and potential participation in this research included: Yellowknife's Dené First Nation, North Slave Métis Alliance, K'atl'odeeche First Nation, Hay River Métis Council, Deninu Kué First Nation and the Fort Resolution Métis Council. Consultations were also held with the Northwest Territories and Nunavut Chamber of Mines, the Mackenzie Valley Environmental Impact Assessment Board and local mining researchers based in Yellowknife. Archival research was conducted at the Prince of Wales Northern Heritage Centre, including research in government documents and company records. With permission from archivists, photographs of relevant documents were taken for later review. Guided field observations and photographs of closed and/or abandoned mine sites included: Giant Mine, Con Mine and townsite and Pine Point Mine and townsite. Although no research data was collected from human subjects during the field season, these activities laid the groundwork for future research directly involving community members, as well as further archival and field activities in the region.

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Licence Number: 14386
Location: Wekweëti

Voices of the Caribou People

This research was a video-based effort to document knowledge of caribou people about ecological changes. The aim was to collect observations, impressions and concerns of the indigenous people about caribou in the form of short documentaries and share them with other communities, scientists and general public. This was part of a larger project of CircumArctic Rangifer Monitoring and Assessment— International Polar Year research on caribou and people, and was conducted across North America. The method of data collection was by video documenting interviews with community members. Data collection in the Northwest Territories primarily took place in Wekweëti and upon invitation from Łutselk'e, interviews were conducted there also. Altogether, twenty-seven people were interviewed in the Northwest Territories with elders, active hunters, women and youth as the focus of the interviews. The final report was in the form of a documentary and was made available on the CircumArctic Rangifer Monitoring and Assessment website for free download. A short film titled 'Voices of the Caribou people' was produced and can be viewed at: <http://www.carmanetwork.com/pages/viewpage.action?pagelId=1114238>. The film was sent to participating communities for wider circulation.

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Location: Fort McPherson, Tsiigehtchic, Inuvik, Aklavik and Tuktoyaktuk

Musical Interaction and Globalization in the Mackenzie Delta and Herschel Island: 1850 - 1950

During summer 2008, research was conducted in the communities of Tuktoyaktuk, Aklavik, Inuvik, Tsiigehtchic and Fort McPherson to assess the state of music in the Mackenzie Delta region. Fieldwork consisted of observing,

recording and participating in musical activities and interviewing musicians and non-musicians both formally and informally.

During the past 160 years, dynamic cultural change in the region has produced a wide range of musical styles including Inuvialuit and Inupiaq drum dance and song, Dené song, fiddling/jigging and "square" dancing, country & western, rock 'n' roll, contemporary rock, rap and hip hop and church hymn singing.

Local populations strove to revitalize their indigenous drum dance and song traditions. Fiddling, jigging and "square dancing" have remained a vibrant component of musical life in the region while country & western music continued to be one of the most popular musical genres with interest crossing over to all generations. Middle-aged people frequently played and listened to rock while the youth generally gravitated to more contemporary musical forms such as rap and hip-hop. Lastly, the more contemporary arrangements of Pentecostal and Baptist church music attracted greater appeal than traditional Anglican and Catholic hymn singing.

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File Number: 12 408 067

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Region(s): GW

Location: Fort McPherson

Gwich'in Traditional Food for Health

The intent of this study is to create sustainable, community-driven activities to improve diet for the Tetlit Gwich'in. Early in 2008, a training session on conducting community research in Yellowknife was attended and a successful visit of community food programs was carried out. In February, activities included "Drop the Pop Northwest Territories" and food preparation classes where youth cooked and served elders.

A food recipe and health book project was started in the community. Elders and many members of the community were communicated with through home visits and the local radio station, CBQM. The traditional food team set up a booth at the Dené National Assembly, which was held in Fort McPherson. DVDs were shared and recipes for the food and health book were gathered.

In the fall, the recipes and incorporated health messages were compiled and edited; the food and health book will be published early in 2009 and distributed to all households. Recipients of the book will be interviewed for their impressions of its usefulness.

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File Number: 12 410 827

Licence Number: 14405

Region(s): IN, GW

Location: Inuvik

Canada's North - A Place to Call Home in the Land of Opportunities

The objective of this research was to investigate how non-aboriginal residents of the NWT acquire northern identities and how it impacts their participation in resource development consultations or decisions. Six respondents of non-aboriginal ethnicity; three males and three females were part of this study. Semi-structured interviews were conducted with respondents, lasting from half an hour to one hour; respondents were interviewed in either their home or office. Each was given an information sheet, signed a consent form and were advised of the ethics protocol.

Post interview, qualitative analysis techniques were employed to identify common themes. Five themes were identified:

- Adventure as a prime motivator for initially coming north;
- Family as a crucial motivator for leaving/staying in the north;
- The land and the benefits of a small town life are important in creating the sense of the north as home;

- A sustainable economy is important for the overall growth of the north, which should include some non-renewable resource development;
- A balanced approach is recommended for the scope and pace of non-renewable resource development with a deferral to Inuvialuit and/or Gwich'in preferences for sensitive areas;

This study was an initial foray into the opinions and attitudes of non-aboriginal northerners. Future studies could examine a larger number of respondents to gain a more comprehensive understanding of non-aboriginal northerners and how they shape and are shaped by the north.

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Location: Inuvik, Fort McPherson and Aklavik

Understanding Aboriginal Involvement In the Joint Review Panel Proceedings for the Mackenzie Gas Project: a Study of Factors Influencing Aboriginal Participation in the Inuvik Region

The objective of this study was to look at the factors impacting aboriginal participation in the Joint Review Panel proceedings for the Mackenzie Gas Project. To meet this objective, a program evaluation of the Joint Review Panel's public participation initiatives and an exploratory study of contextual factors impacting community member involvement in the proceedings were conducted.

The results of the program evaluation indicated that the Joint Review Panel performed well with respect to the early involvement, process clarity and benefits evaluative criteria. Nevertheless, the process exhibited weaknesses in respect of cultural compatibility, representativeness, resource accessibility, independence and cost-effectiveness. The results of the exploratory study of contextual factors indicated that aboriginal participation in the Joint Review Panel proceedings was further influenced by five over-lapping contextual factors of socio-economic status, social relationships, consultation fatigue, Euro-Canadian colonialism and relevance.

These research findings suggest that policy makers and environmental assessment practitioners should ensure that northern environmental assessment processes recognize and reflect unique regional, cultural and socio-economic circumstances and contextual factors such as those identified by this research project, particularly with respect to consultation format and information dissemination.

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Licence Number: 14327
Location: Łutselk'e

The Relationship of the Social Economy to Community Development and Park Creation: A Case Study of Łutselk'e

The community of Łutselk'e, Northwest Territories has become the gateway to a national park; however, community members still have concerns about the implications of the creation of a national park in their traditional territory and questions about how to maximize local benefit from the creation of the park. This collaborative action research project between the Łutselk'e Dené First Nation and the researchers explored perceived and desired community benefits relating to park development, examined capacity building objectives in order to maximize local benefit, and examined the role of the social economy in achieving the community's development objectives. A combination of formal (recorded) and informal ethnographic interviews with band members, non-band community members and external participants were used to explore these three lines of inquiry. A total of forty-four interviews were conducted in Łutselk'e, Fort Smith and Yellowknife. Results from this research were returned to the community in a report and several publications.

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Region(s): SS

Licence Number: 14315

Location: Paul W. Kaeser Secondary School in Fort Smith

I Read It, But I Don't Get It - The Effect of SmartReading Instruction on the Performance and Motivation of Adolescent Readers

This study will measure student motivation to read before and after the implementation of the SmartReading approach, equip teachers with resources to use the reading strategies, and share successes to shape instruction.

This project involved the use of SmartReading (a classroom approach designed to improve reading comprehension skills). Data was collected from teachers in the form of surveys and reflection logs. Data was collected from students in the form of surveys, interviews and classroom observations. Twelve students were selected to participate in an interview regarding their habits and attitudes to reading. Six students with high scores, and six students with low scores were chosen from grades seven and ten. From February to June teachers implemented reading strategies and then completed a survey to measure changes in their concerns and growth after the implementation of teaching tools. Teachers administered the student survey and interviewed the participants. Approximately one hundred five students and eight staff were surveyed.

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File Number: 12 410 665

Region(s): IN

Licence Number: 14313

Location: Sachs Harbour and Tuktoyaktuk

Things Change, We Change: Planning for Community Resilience in the Canadian Arctic

This project examined the community governance implications of climate changes in three Arctic communities. Local physical hazard evaluations were supplemented with community resilience assessments in order to reveal significant adaptation challenges stemming from human resource, organizational and relational factors.

The Inuvialuit Settlement Region research that was delayed for medical reasons in 2007 proceeded in 2008. A special research agreement negotiated with the Government of the Northwest Territories Department of Municipal and Community Affairs (MACA) enhanced information sharing. The Sachs Harbour consultation summary served to facilitate the hamlet's submission to the MACA 2007 Community Capacity Grant call. A family centre/gathering place - one of the priority infrastructure items identified by community members - subsequently received funding.

Wrap-up visits were made to Tuktoyaktuk and Sachs Harbour. Final editorial sessions respecting community adaptation planning process outcomes were completed in each hamlet and discussed with regional MACA staff.

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Region(s): IN, W

Licence Number: 14314

Location: Inuvik

"Take It From the Top" Northern Perspectives on: Southern Canada, Newcomers to the North, and their Land and People

The "Take it from the Top" student research project objective was: 1) to train students to conduct primary research using video interviews and reflective assignments; 2) to support learning and increased research by Northerners; and 3) to create a high quality learning tool for students. Student researchers designed the research questions and set the research terms allowing them to collect twenty-two interviews throughout the area, including Rick Mercer. In the fall

there was an additional eight interviews collected and the research guide was revisited, expanded and refined. Funding was received that allowed for workshop training for the students involved. The video series will become available in late fall of 2009.

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Location: Yellowknife

What Are the Issues Related to Regional Intergovernmental Cooperation and Coordination within Disaster and Emergency Management?

An increased threat risk environment has led to changes in the Canadian disaster and emergency management system. These changes have been initiated by the federal government in a top down approach and have been criticized for a lack of effectiveness and the speed of implementation. The intent of this major research project was to highlight the importance of intergovernmental cooperation and coordination, identify the factors, which promote or impede its development and describe its relationship within the Canadian system. In addition, a thorough examination of the disaster and emergency management system in the northern region of Canada was conducted. This included a review of relevant documentation and stakeholder interviews, to provide an understanding of cooperation and coordination issues at the provincial/territorial level, where provincial/territorial Emergency Management Organizations manage the disaster and emergency management system resources, and when required, integrate federal and military support.

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Region(s): NS

Licence Number: 14409
Location: Behchokq, Gamèti, Whati, Wekweèti and Yellowknife

Socio-economic Surveys for Fortune Minerals NICO Project

No fieldwork was pursued under this NWT Scientific Research Licence.

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Location: Yellowknife

The Dynamic of Change: Place Attachment in Yellowknife

This research examined sense of place in Yellowknife and how it has changed over the past twenty years. Yellowknife benefits from primary resource development. The boom-bust nature of this economy affects how residents use and perceive place in the city. Given that a significant portion of people were not raised in the north, it is important to understand the sense of place associated with these residents.

Data was collected from twenty people living in Yellowknife representing those residents who were not raised in the north but have lived there for more than fifteen consecutive years. Research methods included participant employed photography, semi-structured interviews and direct observation. Results showed that the economic benefits associated with the recent boom period and the natural landscape surrounding Yellowknife were important components of sense of place. More prominent however, was the influence of social interactions and relationships within the community that fostered a strong sense of place that has intensified over time. This research contributed to a growing body of literature by exploring sense of place over time using photographs as the primary data source.

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Region(s): IN, GW, SA, NS,
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Licence Number: 14302

Location: All communities in the Northwest Territories

Mapping the Social Economy in Northern Canada – 2008 Northwest Territories Project

The purpose of this project was to develop a comprehensive inventory of social economy organizations that exist in Nunavut, the Northwest Territories, Yukon, Nunavik and Labrador. Social economy groups are mostly non-profit organizations, including advocacy groups, voluntary organizations and other community-based organizations, including cooperatives. The term "voluntary and community sector" were terms more commonly used in the North. Social economy organizations produced goods and services for members and community with a clear social mission. They put people as priority over capital. Their management is independent of government, and workers/ volunteers/ users used a democratic process for decision-making.

In order to get a clear picture of what and how social economy groups operated in these northern territories a questionnaire was developed and distributed by email and mail. As Social Economy Research Network of Northern Canada is part of a National Research Network, the draft questionnaire was distributed widely for review and feedback before distribution. Once completed the questionnaire was translated into Inuktitut, Inuinnaqtun and French. Questionnaires were distributed by e-mail.

The survey was designed to determine the types of organizations, their activities and the number of members/people in these groups. Respondents were also asked to list research needs and priorities of their organizations in order to guide research priorities and assist with establishing research partnerships and collaborations. The responses have been tabulated in a database and the results analyzed and summarized.

The results of this study were communicated widely to individuals and communities in the North through a newsletter and through a report for community groups. The Social Economy Research Network of Northern Canada provided information through various written media including regular newsletters, website postings (<http://dl1.yukoncollege.yk.ca/sernnoca>) with discussion sessions and an intranet site for participating members. The website provided a discussion site to enable feedback and input throughout the project. The results of the study were shared with other social economy research nodes and were presented at conferences, seminars and published in various journals.

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File Number: 12 410 811

Region(s): IN, GW

Licence Number: 14271

Location: Aklavik, Inuvik, Tuktoyaktuk, Fort McPherson, Tsiigehtchic.

Arctic Borderlands Ecological Knowledge Co-op - Community Based Ecological Monitoring Program

The purpose of this study was to use both local and scientific knowledge to monitor and assess changes in an area that covers the range of the Porcupine Caribou Herd and nearby coastal and marine areas. Interviews with local experts were conducted. Observations about fish, berries, caribou, unusual animal sightings, weather conditions and other aspects of the environment were recorded.

Community monitors reviewed interview procedures in Inuvik before the survey work was conducted. The main message from this 2008 research was the seasonal locations of the Porcupine Caribou herd remained mostly in Alaska and were not available for harvest in Yukon and NWT. Substantive discussion about the impacts of the herd's location on communities and causes dominated several sessions of the annual working group's meeting. Complete reports are available from the researchers or at www.taiga.net/coop.

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File Number: 12 410 815

Region(s): IN

Licence Number: 14298

Location: Inuvik and Paulatuk

Impact of Participation in the Wage Economy on Traditional Harvesting, Dietary Patterns and Social Networks in the Inuvialuit Settlement Region

Twenty interviews were conducted in Paulatuk and two interviews in Inuvik with the goal of understanding how work impacts:

1. the ability of community members to harvest traditional foods from the land;
2. the types of foods that community members eat;
3. networks used to distribute traditional foods in the community.

Results showed that income from work helped to support harvesting activities, however the type of work (full-time, part-time, seasonal, rotational), flexibility of work and the time of year when a job took place, were all important factors in allowing community members to harvest traditional foods. In Paulatuk, 75% of participants expressed a desire to spend more time on the land. The cost and availability of store-bought foods was of concern to participants. In Paulatuk, the cost of meat, dairy, staples including flour, lard, butter, coffee, tea and sugar, seafoods and 'everything' was of concern to participants.

Factors such as the cost of gas and equipment, as well as wildlife quotas played a role in traditional harvesting activities. Sharing continued to occur, however wildlife quotas have limited the access to certain traditional foods through social networks.

A food security workshop is planned for the summer of 2009 to look at food security issues in Paulatuk.

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File Number: 12 410 812

Region(s): NS

Licence Number: 14274

Location: Dettah, N'Dilo and Yellowknife

The Importance of Collective Identity Clarity

The purpose of this research was to investigate the role of cultural identity in the development of self-esteem and psychological well being among aboriginal peoples. Survey research was conducted in Yellowknife, N'Dilo and Dettah in the Northwest Territories with members of the Yellowknife's Dené First Nation. The results showed that the more a person feels that they clearly understand the values, behaviours, expectations, norms, histories and other characteristics of their aboriginal culture, the better they feel about themselves and their lives. Participants who had a clearer sense of their cultural identity also had higher levels of self-esteem, more positive feelings in general and felt that they knew themselves better. Throughout the research, it became apparent that many Dené young adults chose to adopt hip-hop culture and integrate it into their identities. An investigation of this phenomenon was pertinent to understanding the cultural identity of the participants. Therefore, some young adult members of the Yellowknife Dené First Nation were also asked about their aboriginal and hip-hop identities. Participants indicated that they had not rejected their Aboriginal culture in favor of a new mainstream hip-hop identity and that many important aspects of their lives still derive from Dené culture. It was noted that some participants even used hip-hop to explore their traditional Aboriginal culture, blending these identities.



Physical Science

Photo Credit: ARI

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File Number: 12 404 371
Region(s): IN

License Number: 14304
Location: Oceanic region of the Mackenzie Shelf, Shelf Break and Amundsen Gulf

Circumpolar Flaw Lead System Study - Part 1 (Ship-based Research)

The Circumpolar Flaw Lead System Study was a Canadian-led International Polar Year multidisciplinary initiative, designed to examine the importance of climate processes in the northern Hemisphere, and the impact of changes in these processes on the Arctic ecosystem.

In 2008, over three hundred fifty Circumpolar Flaw Lead participants from twelve countries did research from the CCGS Amundsen. The ship operated in 'drift mode' from January to June - parked in a suitable piece of ice until conditions forced the ship to move to another location, where it operated in 'open water mode' from June to August. A total of 34 drift stations and about one hundred open water stations were sampled over 220 days at sea. Thousands of ice, water, air and biotic samples were collected for physical, chemical and biological analyses. In August 2008, the Circumpolar Flaw Lead-International Polar Year project entered a phase of data analysis and results preparation.

Outreach onboard the Amundsen included three Schools on Board programs (National, International, and Circumarctic Inuit), an Artists on Board program, media, an Inuit Policy Workshop, a British High Commission VIP visit and community visits from Paulatuk and Ulukhaktok.

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File Number: 12 404 679
Region(s): GW, SA, DC

Licence Number: 14341
Location: Near Norman Wells, Inuvik and Fort Simpson

2007-2008 API-IPY

Recent Changes In Carbon Source-sink Relationships and Greenhouse Gas Emissions In Forest and Peatland Ecosystems Along the Mackenzie Valley Region of Canada

The Mackenzie Valley region of north western Canada underwent the most warming (1.7°C) over the last century. In light of such observed climate change, forest and peatland ecosystems in the Mackenzie Valley region likely changed as well. This study improved the understanding of the potential impacts of climate change, and associated disturbances, on vegetation distribution, carbon storage and accumulation rates, greenhouse gas dynamics, as well as carbon source/sink relationships in forest and peatland ecosystems within the Mackenzie Valley region. As part of the study, the information collected was used to develop a model of carbon storage and dynamics to predict future impacts of climate change and disturbances in northern forest and peatland ecosystems. Because soils in northern permafrost regions contained large amounts of organic carbon, as the climate warms, the thickness of the active layer (depth of surface soil thaw in the summer) exposed to decomposition increases. Consequently, warming of permafrost soils could increase greenhouse gases (carbon dioxide (CO₂) and methane (CH₄)) emissions to the atmosphere. It is important to study these northern forest and peatland systems because of the pivotal role they play in the global carbon cycle, either removing/emitting greenhouse gases from/to the atmosphere in response to climate changes.

In the spring of 2007, four intensive monitoring sites were established throughout the Mackenzie Valley and northern Alberta, with locations in the regions of Inuvik, Norman Wells, Fort Simpson and Fort McMurray. Two or three plot locations at each site allowed for investigation of upland forests and peatlands, both those affected by permafrost (peat plateaux) and areas where permafrost has thawed (collapse scars). Measurements on these plots included: tree, shrub, herb and ground layer species composition and biomass; soil active layer depth; canopy closure; lichen biomass measurements and soil, as well as, water chemistry measurements. Measurement of carbon dioxide and methane were conducted in both 2007 and 2008. Additionally, mini weather stations at each site to continuously monitor the air temperature, humidity, wind speed and wind direction were installed during 2007 and 2008. At each plot, another set of continuous monitoring instrumentation was also installed in 2007 and 2008 to record soil moisture, soil temperature, soil carbon dioxide and oxygen concentrations as well as the soil reduction – oxidation conditions. All these monitored variables were important to understand how the local environmental conditions affect greenhouse gas dynamics.

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File Number: 12 404 692
Region(s): IN

Licence Number: 14336
Location: Beaufort Sea from west of Banks Island to the US/Canada border, more than 50 kilometres away from the coast

Impact of Melt Ponds On Energy and Momentum Fluxes Between Atmosphere and Sea Ice

Melt ponds at the surface of the Arctic Ocean ice usually formed from the end of May to the end of August. They have a strong impact on the energy exchange between atmosphere, sea ice and ocean. The most important effect is the enhancement of absorption of solar radiation due to the considerably lower reflectance of melt ponds than that of the surrounding snow/ice. The goal of the project Impact of Melt Ponds on Energy and Momentum Fluxes between Atmosphere and Sea Ice was to improve the quantitative understanding of the impact of melt ponds on radiation, heat, moisture and momentum fluxes over Arctic sea ice.

In the phase of the melt season, when melt ponds begin to form, the description of the temporal evolution of pond fraction and reflectance in sea ice and climate models was particularly incorrect. Therefore, the campaign took place in late spring and early summer. The research aircraft POLAR 5 operated in the Canadian Arctic, mainly over the southern Beaufort Sea with Inuvik as airbase. For a measurement flight over rough multi-year ice north of Ellesmere Island POLAR 5 was transferred to Eureka. Overall, twelve measurement flights were performed.

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File Number: 12 404 576
Region(s): IN

Licence Number: 14394
Location: Canadian Beaufort continental shelf

Beaufort Shelf Seabed Mapping Project

In August-September 2008 the Geological Survey of Canada in collaboration with the Canadian Hydrographic Service conducted a seabed-mapping program from the Canadian Coast Guard vessel Nahidik. Research was focused on investigating geohazard and geoenvironmental constraints to offshore hydrocarbon development and transportation. Sediment sampling was done to assess seabed stability conditions. The repetitive seabed-mapping program revealed 17 new extreme ice scours with depths ranging from 2 to 3.2 metres in water depths of 16 to 35 metres. The multilayered structure of subsea permafrost to depths of 200 metres below seabed was investigated using digital multichannel seismic reflection technology. Two abandoned artificial islands used as the foundation for exploration drilling in the 1980s were surveyed to determine the fate of the submerged islands over the last 25 years. Shallow gas continued to vent from the seabed at the Kugmallit Bay site, which has been active for the last 5 years. Seabed video imagery revealed the presence of benthic fauna in water depths of 450 metres on the upper continental slope. These data will be contributed to the International Polar Year Arctic Ocean Diversity project. The marine mammal monitoring program resulted only in the occasional sighting of seals and whales.

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File Number: 12 404 653**Region(s):** NS, SS**Licence Number:** 14323**Location:** Diavik Diamond Mine, Lac de Gras Mine Site**Waste Rock Studies at a Diamond Mine Site**

At the Diavik Diamond Mine, open pit mining lead to the development of permanent stockpiles of waste rock. The objectives of this study are to determine the potential environmental impact of the Diavik waste rock, and to evaluate the use of laboratory tests to estimate the environmental effects waste rock piles. This study involves the construction and monitoring of three large-scale experimental waste rock piles to measure water flow, water chemistry, rock temperature and how the waste rock changes over time. Construction of the test piles was completed in 2007. The experimental piles contained rock with very low concentrations of sulfide minerals, typical of the rock present at the Diavik site. In 2008, monitoring of the experimental piles was conducted to measure pore-gas concentrations and gas transport, water flow, water chemistry, microbiology and changes in the waste rock temperature. Laboratory studies involving small test samples were initiated in 2004 and continued throughout 2008. This experimental program allowed a direct comparison of results measured at different scales and improve the assessment of the applicability of laboratory testing approaches typically used at the mine planning stage.

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**File Number:** 12 404 325**Region(s):** IN**Licence Number:** 14383**Location:** Illisarvik & near Paulatuk and Inuvik**Permafrost and Climate Change, Western Arctic Canada**

In 2008, field activities were conducted in the Western Arctic with the objective of determining how permafrost conditions will respond to climate change. A 52 metre deep hole was drilled to find out how permafrost temperatures there have responded to climate change in Illisarvik. An attempt was made to drill the hole to 100 metres depth, but could not be drilled past 53 metres. Some benchmarks were installed against which ground subsidence following climate warming could be measured.

The experiment to start ice-wedge cracking by reducing snow depth in the drained-lake basin, (done by cutting the grass over the research plot) was completed. The snow depth was much less in the cleared area of the lake basin. It took five years for the ground to cool down enough to crack in winter. Cracking for three years in a row was observed, and now research will examine how long it takes for the ground to recover to pre-disturbance temperatures.

At Paulatuk another cable to 25 m depth was installed. Parks Canada staff continued to monitor ground temperatures at three sites. Measure rates of rock abrasion by blowing snow and sand were going to be measured, but all the experimental rocks installed in 2007 were removed.

Near Inuvik ground behaviour in a peatland was monitored. The permafrost there is very "warm" (-1.5°C), and it will take little further warming to melt it. At other sites near Inuvik the ground temperature is cooler, approximately -3.5°C.

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File Number: 12 404 686

Licence Number: 14266

Region(s): IN

Location: Parry Peninsula (near Paulatuk, NWT)

Diadem Resources Ltd. Franklin Diamond Project 2007/2008 Gradiometer Magnetometer Survey

The purpose of this project was to conduct GPS-based gradiometer magnetometer (a ground magnetic survey) on its Franklin Diamond Project.

The survey was designed to more precisely locate and define a number of airborne magnetic variances on the ground that Diadem management determined was necessary prior to initiating a diamond drilling program. Collectively, a total of 327.7 kilometres of survey was carried out over thirteen individual control grids overlying 16 separate airborne magnetic anomalies.

The survey used three GSM-19W walking v7.0 Overhauser magnetometer systems (roving magnetometers) with an associated GPS board. Two stationary non-GPS base station GSM v7.0 magnetometers were also used in the survey to measure the diurnal variation in the earth's magnetic field within the survey area. Magnetic data were collected on foot with three instrument operators reading the "roving" magnetometers. Unrefined field data suggested that several of the airborne magnetic differences that were surveyed on the ground have magnetic signatures similar to those recorded by previous ground surveys over known diamond-bearing kimberlite pipes on the project. The ground magnetic anomalies were characterized by well-defined, circular magnetic lows and magnetic high signatures that appeared to be spatially related to major structural features. The magnetic expressions of the known kimberlite pipes on the Diadem property contrasted sharply with the weakly magnetic carbonate and clastic sedimentary rocks that they have intruded, enabling the recognition of potential kimberlite pipes with a high confidence level.

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File Number: 12 404 700

Licence Number: 14412

Region(s): NS

Location: Outside Yellowknife

Sedimentology and Stratigraphy of Middle Devonian Carbonates in the Great Slave Lake District

The purpose of this fieldwork was to examine the Devonian-aged rocks in the Great Slave Lake area. These rocks were the result of a shallow inland ocean basin created during an interval of sea-level rise from early to late Devonian period. The rocks examined were part of two formations called the Chinchaga Formation and the Lonely Bay Formation.

Twelve localities were visited in 2008. Most of the rocks were located along Highway #3, west of Rae, and one location was accessed by helicopter. During the fieldwork, the rock sections were measured, sampled, and photographed.

The Chinchaga Formation is formed of evaporites, collapse breccias, hard resistant dolomite and limestone. The overlying Lonely Bay Formation rocks were formed largely from lime mud with scattered corals and brachiopods fossils. There were also thick intervals of the Lonely Bay that contain maze trace fossils.

Previous work for this project included examining drill-core from the Great Slave Lake area. This work was inconclusive and did not give an accurate representation of the distribution of Devonian rocks. This fieldwork provided insight into the regional geology and a better understanding of the history of sea level rise throughout the Devonian in the Northwest Territories.

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API-IPY

File Number: 12 404 694**Region(s):** NS**Licence Number:** 14348**Location:** Daring Lake Terrestrial Ecological Research Station and upland tundra

Climate Change Impacts on Canadian Arctic Tundra Ecosystems: Interdisciplinary and Multi-scale Assessments

Nitrogen fixation by cyanobacteria provides an important source of nitrogen (N) in arctic tundra ecosystems. Cyanobacteria can be found in lichen symbioses and can colonize both soil crusts and mosses. Temporal and spatial variability of N₂-fixation was assessed during the growing season of 2008 at Daring Lake. The highest rates of fixation for most N₂-fixing associations occurred in July. The lichen *Stereocaulon* sp. had the highest rates of fixation in all months compared with other N₂-fixing associations. Hollow mosses had lower rates in early summer and soil crusts had lower rates in late summer. Moisture appears to be a major limiting factor for fixation with temperature and light being of secondary importance. Comparison of nutrient availability over the growing season immediately below hollow mosses, soil crusts on mineral mounds and *Stereocaulon* sp. indicated higher availability of total N, NH₄⁺-N and P below *Stereocaulon* sp.

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File Number: 12 412 030**Region(s):** IN**Licence Number:** 14372**Location:** The Anderson River (N68 10.634, W125 48.573) & two kilometres upstream of this point

Lower Devonian Fossil Fishes from the Anderson River

This research examined rocks to find fossilized skeletons of long-extinct fishes, and sampled them for study to learn more about the early history and evolution of fish. The researchers cracked and split limestone and shale rocks along the shores of the river to find fossil bones and teeth of fish. The rocks in which the fossils were found were 400 million years old, and were once the soft bottom of a warm, shallow sea that covered much of what is now the Northwest Territories.

The research team found remains of four major kinds of extinct fossil fish in the rocks. The most exciting discovery was parts of arthrodires, which were large, armored predatory fish with spines. These arthrodires would have been about a meter long, and had a thick, bony head shield. This may be a species new to science. Also found were fossils of parts of large predatory fish called porolepiforms, which had large, hard scales; a very early lungfish, which has air-breathing relatives living today in freshwater in Africa, Australia and South America; and a fossil fish called Dialipina, the earliest known ray-finned fish, like most fish living today. It will take about two years for the fossil bones to be removed from the rock for study.

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File Number: 12 404 359**Region(s):** IN**Licence Number:** 14279**Location:** Mallik research well-site, Mallik Bay, Richards Island (69°27.671'N, 134°39.680'W).

2006-2008 Aurora-JOGMEC-NRCAN Mallik Gas Hydrate Research and Development Project

Gas hydrates are thought to represent a vast potential energy resource for Canada with concentrated deposits known to occur in the Mackenzie-Beaufort area. The 2006-2008 Mallik gas hydrate production research program was

conducted to evaluate the natural properties of gas hydrates, and for the first time to measure and monitor their long-term production behavior. Results from the short-duration production test completed in 2007 confirmed a vigorous reservoir response to stimulation by depressurization, with increasing gas flow during the testing period. However, the operational problems due to sand in flow into the well limited the test duration. Measures were taken in 2008 to overcome these problems and a six-day test was undertaken without interruption. The project participants felt proof of concept has been established that gas hydrates can be recovered using conventional oil and gas production techniques modified for the unique properties of gas hydrates. Scientific and engineering results from the program were made available to scientists, regulators and northern stakeholders through the release of publicly available reports and databases.

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File Number: 12 404 359

Region(s): IN

Licence Number: 14305

Location: Big Lake, Kimialuk Lake, Middle Channel and two un-named lakes
(69°14'30"N, 135°20'22"W and 69°13'15"N, 135°14'31"W)

Integrated Geoscience Studies of the Mackenzie Delta and Nearby Coastal Environments

Permafrost and gas hydrates occurring beneath the Mackenzie Delta and Beaufort Sea shelf have been experiencing warming associated with Holocene climate change and geologic processes such as marine transgression, lake and river formation. This project attempted to quantify the release of methane from these environments with special emphasis on the permafrost and gas hydrate setting. Research conducted in 2008 has documented geochemical signatures for a dozen gas seeps, indicating both shallow biogenic sources and deeper thermogenic sources. The flux or release of methane from these features was observed to vary from 103 m³ to 106 m³ on an annual basis. In at least one case, it was conclusively determined that seismic drilling carried out in 2004 had initiated a gas seep which was still active in October 2008. Scientific results from this research were made available to scientists, regulators and northern stakeholders through the release of publicly available reports and databases.

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File Number: 12 404 695

Region(s): SA

Licence Number: 14351

Location: Six locations in the Sahtu Region

Sedimentology of the Cretaceous in the Mackenzie Corridor

The goal of the project was to describe the Early Cretaceous rocks and create a model of the Cretaceous landscape. At each field location the rocks were photographed, measured and described. Fist-sized samples were gathered for microscope analysis and dating. Office work with seismic and well data suggested that the composition of the Cretaceous rocks was strongly influenced by the Cretaceous landscape. The Keele Arch and Mahoney Arch, both interpreted as landscape highs, did not get the same composition, or volume of sediment as the Brackett Basin. Field observations supported this interpretation. The rocks observed in the two western locations, on Imperial River and near Bear Rock, were interpreted as marine due to glauconite, preserved burrows from crustaceans, and fragments of shells. The sandstones and mudstones suggest a change to lower energy, possibly a deepening of the Cretaceous-aged Ocean. The rocks observed at Kelly Lake were current-influenced sandstones without any burrows or fossils, so may have been either marine or fluvial. Data indicates that Kelly Lake was located on the Keele Arch and was likely younger and/or has a different sediment source than the western locations. The Mahoney Lake location had cross-bedded, pebble-sized sandstone without burrows. It was interpreted as a much higher energy environment, either marine or fluvial. It was located on the Mahoney Arch and may have been younger again than the Kelly Lake rocks, or of a different sediment source.

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File Number: 12 406 051
Region(s): NS, SS

Licence Number: 14389

Location: Matthews Creek Project Site, situated between Courageous Lake and Matthews Lake.

Matthews Creek Hydrometeorological Survey

The objective of this research was to document Matthews Creek stages and discharges on a single creek transect, and download the data from and maintain the existing meteorological station. This research provided baseline information for the area.

A total of three sites were visited 2008. Aircraft was used to bring in a two person team and necessary equipment to the site. During the site visit, tasks included: creek discharges measurements, meteorological station and all-weather precipitation gauge inspections, data downloads from the data logger and necessary maintenance.

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File Number: 12 404 141
Region(s): IN

Licence Number: 14358

Location: Several sites on Banks Island

Environmental Change in the Western Canadian Arctic Islands

Three related field projects were conducted on Banks Island aimed to clarify the natural history of Banks Island by investigating late Quaternary glacial and sea level history. Researchers were based on Banks Island with camps at Parker Point, Polar Bear Cabin, Ballast Brook, Thomsen River, Jesse Bay, Masik River, Kellett River and Angus Lake. These studies surveyed glacial landforms and raised marine sediments to constrain the history of glaciation and relative sea level change in the western Canadian Arctic. Several samples of fossil molluscs and driftwood were collected from the deposits and prepared for radiocarbon dating. In addition, rock samples were analyzed for cosmogenic exposure age dating and U-Pb zircon dating. These data enabled a reconstruction of past environmental variability, which placed modern changes in a more accurate context, thus making it possible to understand future climatic and environmental change.

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Region(s): NS

Licence Number: 14320

Location: 50 kilometres radius of the Daring Lake Tundra Ecosystem Research Station

Assessing Snowpack Water Equivalent Distribution In the Exeter-Yamba-Daring Lake Catchment, Coppermine River Basin for Passive Microwave Algorithm Development and Stable Isotope Analysis

The purpose of this research was to develop a more complete understanding of open tundra snow cover properties and distribution. During the late winter of 2008, data collection took place and proved to be a valuable addition to the research project which was initiated with snow surveys in 2003. The objectives of the 2008 field work were: 1) to obtain additional snow cover data for ongoing comparison to satellite images; 2) to test new sampling methods based on snow data analysis done to date; 3) to sample snow and lake cover properties for comparison with AMSR-E satellite data; and 4) to sample snow cover and terrain to correspond with multi-scale, aircraft based passive microwave data.

Analysis of the 2005 airborne radiometer data collected in the study area demonstrated the important contribution made by multi-scale passive microwave data to understanding satellite scale issues. Results derived from the 2005 data were encouraging; however, the ground data collected were mainly discrete point measurements along flight lines or at flight line intersections. The flights in 2008 were conducted over a smaller area so that nearly continuous detailed ground measurements of snow and terrain could be made along flight lines. Snow cover measurements were collected with an automated GPS-equipped snow probe (magnaprobe) at fixed intervals about 8 metres over 40 kilometres of flight line transects and at an additional 147 sites which were sampled randomly at intervals along the flight lines. The magnaprobe data are very useful for plotting snow depth as it varies nearly continuously across a landscape. The 40 kilometres of magnaprobe data, combined with the 147 discrete sites provided a much more comprehensive dataset for comparing to continuous transects of airborne brightness temperature.

By addressing these fundamental issues, it was shown that the conventional brightness temperature approach (37-19 GHz) used widely across the international remote sensing community, was not appropriate for tundra applications. Instead, a prototype single frequency algorithm that is insensitive to lake fraction was developed. This algorithm was incorporated into a new passive microwave processing system in the Climate Research Division of Environment Canada. A thirty year data record will be produced from Scanning Multichannel Microwave Radiometer (1978-1987), Special Sensor Microwave/Imager (1987-2002) and Advanced Microwave Scanning Radiometer (2002-present) data.

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File Number: 12 404 555
Region(s): NS

Licence Number: 14411

Location: Daring Lake Drainage Basin and the Upper Coppermine River basin in the Exeter-Yamba-Daring Lake catchment

Nutrient Availability in Arctic Tundra Soils

The objective of this research was to determine the impacts of predicted soil warming scenarios for the arctic on the availability of phosphate, nitrate-nitrogen and ammonium. During the field component of this research small volume soil/regolith samples were taken from six different plant communities, each of which have significantly different environmental characteristics (soil temperature, depth to permafrost table, soil moisture, soil texture, organic matter content). The plant communities sampled included (from dry to wet): Dry Mat Lichen, Dry Birch Hummock, Dry Heath Lichen, Moist Birch Hummock, Wet Birch Hummock and Wet Sedge. Within each plant community, three sites were selected and at each site (measuring 5 x 5 metres) 25 quadrats were quantitatively assessed for percentage of plant species cover. This was done to show and quantify differences in species make-up within each plant community and among plant communities. Three sites were randomly selected and soil pits excavated. Triplicate samples for future experimental use were bagged in clean plastic bags and later the same day frozen in freezers at the Daring Lake Tundra Ecosystem Research Station. Subsamples from each were taken for organic carbon analysis, soil moisture measurements and bulk density and porosity measurements. Soil moisture measurements (using a Hydrosense probe) were taken within each quadrat. Depth to permafrost was recorded in each quadrat.

Samples were flown east and stored in refrigerated conditions (~ +3°C) for 7 months. The soil samples were utilized in a 3 month experiment to compare differences in microbial activity, greenhouse gas emissions (CO₂, N₂O, CO, etc.) between treated (exposed to warmer, wetter conditions in the lab) and non-treated (exposed to dryer, cooler conditions than the treated samples, more in line with current growing season temperatures).

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Region(s): NS, SS

Licence Number: 14356

Location: South of the proposed Izok mine site (in Nunavut) &, along and in the vicinity of the Coppermine River

Biophysical Baseline Studies in Support of the Izok Project

The objectives of the research studies were the following: 1) refine understanding of baseline conditions; 2) provide input to design mitigation; 3) evaluate potential changes in the environment in relation to the Izok Project; and 4) contribute to the ongoing data collection of the Arctic environment.

Researchers collected and reviewed existing documents, reports, studies and statistics from academic, government, community and development sources regarding biophysical information, as well as a complete field season.

Water and sediment quality sampling captured and measured seasonal water quality variability within lakes, rivers and streams throughout the year. The samples helped measure pre-disturbance conditions and aid the development of an Environmental Impact Statement. The samples were collected from Ham and Izok lakes located within Nunavut, and from Itchen and Iznogoudh Lakes extending from Nunavut into the Northwest Territories, as well as their associated watersheds around the project including the Coppermine River watershed.

A snow survey measured late-winter snow depths and densities using a level-logger at selected sites. The snow surveys were conducted in the area of the Ham Lake camp and Izok Lake drainage. Level-loggers were installed at selected sites in Iznogoudh and Itchen Lake around the proposed mine area.

During soil and vegetation sampling, soil and vegetation samples were collected to gauge background metal and mineral concentrations. Vegetation selected for sampling only included common species. The samples provided valuable input into both ecological and human health risk assessments associated with the Izok Project. The sample sites were chosen within an area approximately 5 kilometres around the proposed mine site extending just inside the Northwest Territories border, south of the proposed mine site.

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File Number: 12 404 569
Region(s): IN

Licence Number: 14283
Location: Banks Island (71°43'12"N, 122°02'31"W)

Postglacial Paleoclimatology of the Central and Western Arctic Islands

No research was conducted under this NWT Scientific Research Licence.

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Licence Number: 14296
Location: Along the Hay River from approximately Enterprise to the Town of Hay River

Hay River Ice Jam Study

The 2008 field research program observed, measured and documented breakup of the Hay River. A significant amount of water and ice moved into both Delta channels, resulting in an evacuation and flooding on Vale Island and on the Kátí'odeeche First Nation Reserve. Most notably, the churches in the old village were damaged. Working along side the Town Flood Watch Committee, water levels were measured at key sites, and the river breakup progression was photographed both from the ground and a small airplane. A website was created for the public, to keep residents apprised of breakup conditions as they developed.

In the fall of 2008, some river bathymetry measurements were taken of the West Channel, near the bridges, to refine the river hydraulics model. Ice velocities were documented during freeze-up using photographic techniques and standard surveying instruments. Work on the development of ice jam flood forecasting models continued using this new data and has entered the testing phase.

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File Number: 12 404 696
Region(s): GW

Licence Number: 14353
Location: Upper Rat River near McDougall Pass

Timing and Genesis of the Eagle Meltwater Channel in Northern Yukon: Implications for the Northwestern Laurentide Margin

The objective of this work was to observe and document sediments exposed along the upper Rat River to investigate the timing and nature of glaciation in this region. Approximately fifteen samples of sediments were collected at three locations for radiocarbon dating.

The advance of the Laurentide Ice Sheet into McDougall Pass (top of the Rat River valley) was responsible for blocking east-flowing Yukon drainages and creating a vast glacial lake in the Bell and Old Crow Basins (Glacial Lake Old Crow). The timing of this advance was controversial and much earlier than other records in North America. Information was collected that tested whether this early chronology had support from sediment records in the area of McDougall Pass (and the upper Rat River). Initial dating supported the hypothesis of a last glacial maximum advance in this region around 18,000 years BP (late-Pleistocene Laurentide).

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Region(s): SA

Licence Number: 14397
Location: Within 5 kilometres of the Canol Heritage Trail extending from Macmillan Pass (Yukon border) to Caribou Pass.

Long-term Ecological and Geomorphological Investigations in the Alpine Tundra of the Mackenzie Mountains

The main study objectives of this study were to: 1) determine the status of permafrost landforms in the study area; and 2) determine long-term recovery after abandonment of the CANOL No. 1 project. Long-term ecological and geomorphological investigations in the alpine tundra were completed on the International Polar Year research sites and a third site was added. These locations were selected for study and were marked so that they could be relocated for long-term study of treeline or shrubline shift. Four of the five automated climate stations that were established in 1990 were damaged by animals. The wind sensors appear to attract animals. The memory on the stations was uploaded to a computer and a summary of results was presented. With the exception of one site, 2007 had cooler permafrost temperatures than during recent years. At these sites and at two other sites, the thaw depth was measured along permanently marked sample points. As a result of sampling earlier than other years, the thaw depth was lower than most of the eighteen years over which the study had been under way. The one feature that is almost permafrost-free had a much shallower thaw depth due to the earlier measurement time. Permafrost continued to warm (~0.8 to 1°C) and melting continued at a rate of -1% of the area of permafrost landforms each year.

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File Number: 12 404 515
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Licence Number: 14326
Location: Melville Ice Cap

Mass Balance of Arctic Glaciers and Arctic Pollution

This project was part of a glacier program covering four ice caps and one glacier in Nunavut, including the Melville Ice Cap, in the NWT. The work involved measuring poles drilled into the ice to see if more ice and snow are melting more than it is accumulating. These data were an indicator of climate change. On average, the ice cap has decreased by 19 centimetres water equivalent mass per year since observations began in 1963.

During a visit to the permanently deployed weather station on the ice cap, regular maintenance was completed and data from the 2007-2008 year were collected. These data provided a record of the year-round snow accumulation and temperature for this site. Travel on the ice was by snowmobile and the researchers lived in the hut for the two or three days while there. Results indicate that the ice cap experienced a loss of 1.1 metre of water equivalent mass in 2007. This was about five times greater than the long term average rate of mass loss, and was the greatest amount of melt in a single year since observations began. Also during the 2008 field season, spring thickness and surface elevation of the ice cap were measured by towing a ground penetrating radar and high precision GPS along approximately 50 kilometres of transects across the ice cap.

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File Number: 12 404 545

Region(s): IN, GW

Licence Number: 14306

Location: Sixty locations in the Mackenzie Delta region

Environmental Studies Across Treeline

In 2008, research continued to characterize the permafrost conditions in the Mackenzie Delta region. This work examined the influence of snow cover, vegetation and disturbance on ground temperatures across the treeline and in the Mackenzie Delta. The research showed that disturbances could result in ecological change, which in turn, can alter snow conditions causing permafrost to warm and in some cases to thaw. If this occurred adjacent to lakes, large thaw slumps may be initiated.

Research continued investigating variability in water chemistry of lakes in the Mackenzie Delta region. Monitoring of the effect of thaw slumping on the water quality of small tundra lakes also continued. The lakes affected by thaw slumping had higher ion concentrations and increased clarity with respect to undisturbed tundra lakes. Since thaw slumping is increasing in frequency and magnitude, it is anticipated that thawing permafrost will be a dominant factor influencing lake chemistry in a warming arctic.

Soil samples were obtained in the Delta region to develop a soil sampling protocol for delineating contaminants in patterned ground. A full-scale field experiment was initiated in the outer Mackenzie Delta to investigate the effect of overland winter travel on vegetation, active-layer freezeback and geotechnical stability of the tundra. This information was used to draft guidelines for industry in constructing winter overland roads.

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Region(s): NS

Licence Number: 14276

Location: Daring Lake Tundra Ecosystem Research Station

Tundra-Atmosphere Carbon Exchange

The exchange of carbon dioxide between the atmosphere and arctic tundra near the Daring Lake Terrestrial Research Station had been studied since 2004. Data was collected with instrumentation mounted on tripod towers and by manual sampling with small chamber systems at experimental plots. From these measurements the rates and amount of carbon gas (carbon dioxide and methane) exchanged between the tundra and its various plant communities and the atmosphere were apparent. The main goal was to determine if the tundra is a sink or source for atmospheric carbon. In 2008, measurements concentrating at two sites, the main tower on mesic mixed tundra and a wet lowland sedge fen tundra, were completed. It was a wet and mild summer at Daring Lake and both sites were overall sinks for carbon dioxide and small sources for methane. These results combined with previous years' results helped to understand how variations in climate impact the tundra and eventually, how climate change will affect tundra carbon cycles.

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File Number: 12 402 790
Region(s): GW

Licence Number: 14300
Location: Northern Richardson Mountains, centered on the Black Mountain Block (Goodenough Mountain)

Dall Sheep, Grizzly Bears and Wolves in the Richardson Mountains - Snow Monitoring

To improve understanding of habitat use and the influence of the snow layer on the winter movements of Dall sheep and wolves in the northern Richardson Mountains, snow surveys were conducted in March and April 2008. Two teams traveled the study area and recorded snow depth, slope, aspect, vegetation, elevation and topography in various types of habitat. A total of fifty sites were described, which provided a supplemental source of information to analyze the animals' movement patterns and habitat use. A similar snow survey was also conducted in 2007, and the 2008 data complement information acquired the year before. This study integrated a larger research program involving GPS telemetry on Dall sheep, grizzly bears and wolves; Dall sheep behavioural observations; diet analysis; and the documentation of local and traditional ecological knowledge.

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Licence Number: 14272
Location: Unnamed lake at Shellabear Point, Dundas Peninsula & Melville Island

Climate Change Reconstructed From Lake Sediments

The goal of this project was to collect sediment cores and water samples from a lake, to be analysed as an indication of past snow melt and stream flow in the area. This work followed up preliminary research from 2006. With a field camp concentrated at Cape Bounty, Melville Island, Nunavut (100 kilometres east), field parties composed of two or three scientists were able to be transported via helicopter or twin otter for short durations to the sampling sites.

Fieldwork consisted of water column sampling. This work was designed to understand the chemical evolution of Shellabear Lake, as it was believed that the lake was slowly being cut off from the ocean as the land rises. In addition, short sediment cores were also taken from the bottom of the lake. As the highly saline water of Shellabear Lake (almost twice as salty as the ocean) will aid in the preservation of distinct sediment layers, it was believed the examination of the sediments revealed an accurate record of past climatic conditions.

Water chemistry results and initial analysis of sediment cores indicate that Shellabear Lake will provide important information about lake processes and past climate. Further testing is needed to ensure complete and accurate results. Therefore, further research can be undertaken in 2009. Scientific work will focus on water column sampling and obtaining longer sediment cores. A longer sediment record will enable the climate reconstruction to be extended back thousands of years.

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File Number: 12 404 312
Region(s): IN, GW

Licence Number: 14375
Location: 40 sites across the northern Richardson Mountains.

Geological Reconnaissance and Proposed Field Trip Across the Northern Richardson Mountains and Mackenzie Delta Area

No research was pursued under this NWT Scientific Research Licence.

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File Number: 12 404 485
Region(s): IN, GW

Licence Number: 14333
Location: Within the Mackenzie Delta

International Polar Year - Study of Canadian Arctic River-Delta Fluxes

The general goal of this research was to understand how arctic climate change might affect the amount of water, sediments and nutrients reaching the Arctic Ocean from the Mackenzie River. This improved understanding of how ice breakup affects: 1) river-flow entering the Mackenzie Delta; 2) the volume of water entering the ocean from outer delta channels; 3) water levels through the delta channels and lakes; and 4) filling data gaps on water quality. During the 2008 field season activities successfully completed or progressing included: 1) developing a hydraulic model of river-flow for the delta channels; 2) field observations of ice-jamming during spring breakup; 3) satellite analysis of ice breakup patterns; 4) detailed analysis of delta water level patterns; 5) aircraft-based analysis of delta low-water topography; 6) extent of high-water flooding; 7) modeling of how Beaufort Sea storms surges affect delta water levels; and 8) sampling of water quality in delta channels and lakes. Data analysis and modeling efforts to understand how the information fit together were on going. A webpage explaining more about International Polar Year- Study of Canadian Arctic River-Delta Fluxes is at <http://www.sfu.ca/ipy>.

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File Number: 12 402 777
Region(s): NS

Licence Number: 14390
Location: Lac de Gras

Water Quality Monitoring Camp

The Environmental Monitoring Advisory Board helped Diavik organize a Water Quality Monitoring Workshop. Participants, representing all five Aboriginal Parties to Diavik's Environmental Agreement sampled from the three sites chosen by participants in 2004, the first year the workshop was held. All these sites were around the Diavik mine site and were deemed important relative to depth, currents and man-made physical features within the lake (i.e., dike). These sites were not monitored under Diavik's Aquatic Effects Monitoring Program.

Participants conducted biophysical profiles, as well as taking three water samples at 2 metres below the surface, mid water column depth and 2 metres from the lake bottom. Participants also sampled and screened benthic invertebrates and sampled sediment and plankton.

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File Number: 12 402 811
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Licence Number: 14378
Location: At Sawmill Bay

Detailed Environmental Site Assessment - Sawmill Bay

In 2008, researchers undertook a detailed environmental site assessment of the Sawmill Bay site. During the field program, previously identified impacts to soils and groundwater were found to be limited to relatively small areas. Analysis of surface water and sediments found no evidence of contamination in surface waters, and one sediment sample with minor contamination. Waste materials were inventoried, building dimensions recorded and waste dumps delineated. Most waste materials were non-hazardous (i.e. unpainted wood and/or scrap metal). Most of the approximately 12,100 barrels on the site were empty and unpainted and most remaining barrel contents were suitable for on-site disposal in accordance with NWT regulations. Some remaining paint on buildings, barrels and machinery

exceeded environmental guidelines for lead, and some for polychlorinated biphenyls. A small amount of asbestos was present in some buildings.

Debris in or near the water was surveyed, and evidence of vegetation and wildlife (including Arctic fox, black bear, moose, caribou, ptarmigan, squirrels, frogs, bald eagle, beaver, various birds, lake trout, Arctic char) was documented. Candidate sites for a landfill and sources of fill material were identified. The site was mapped and background environmental data were collected.

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File Number: 12 404 378

Region(s): IN, GW

Licence Number: 14316

Location: Trail Valley Creek, Havikpak Creek and Denis Lagoon, Zed Creek, Hans Creek and on main river channels in the upper and central Mackenzie Delta

Hydrological Studies, Mackenzie Delta Region

Field studies were conducted in the Inuvik area during 2008, looking at the factors controlling the movement of energy and water between the land surface and the atmosphere during the spring snowmelt period. These factors controlled both the supply of energy and water to the atmosphere, as well as snowmelt and therefore spring runoff in the streams and rivers. The long term objective of these studies is to improve the ability to predict weather, climate and water resources. With future uncertainties in climate, and with potential development projects, such improved predictive ability is essential in order to properly manage future environmental change and to adapt to such changes.

Work in 2008 concentrated primarily on measuring total basin snowfall (by the middle of April), as well as usual automated measurements of solar radiation, air and ground temperatures and summer rainfall.

Ongoing work compared results from a number of different years so that the variation from year to year could be understood, and compared with results from areas on either side of the treeline. This work provides important data needed to test computer models, which were used to predict the impact of climate warming on these environments. In addition to this study, 2008 saw a continuation of work on lakes of the outer Delta which involved the measurement of energy fluxes, standard meteorological components, as well as lake inflow/outflow and water depth and temperature.

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File Number: 12 404 698

Region(s): DC

Licence Number: 14392

Location: The Hay River

Cretaceous Ichthyosaur Systematics and Diversity

A team of four paleontologists examined the banks of the Hay River in the area south of Enterprise for the presence of fossils, as well as geological information permitting a precise assessment of the age of the rocks in the area. The bedrock in this region is Lower Cretaceous in age (approximately 110 million years old) and in the past has yielded fossil vertebrates, including fish and ichthyosaurs (extinct marine reptiles). Fossils from the area were very scientifically informative, because of their age and geographical location as well as the exceptional quality of preservation. Unfortunately, the high water level of the Hay River during the course of this study meant that the bedrock was submerged, severely restricting the amount of fossil collecting possible. Some fossil fish were collected from gravel located at the bend of the river, but the water was too deep to collect geological information, or specimens that were coming directly from the bedrock. No marine reptile remains were collected. The fish represent a species new to science, and are currently undergoing detailed study.

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Region(s): SA

Licence Number: 14400

Location: Along 372 kilometres of the Canol Trail (various sites from Mile 0 to Mile 222)

Canol Trail - Logistics Plan Development and Inventory

Reconnaissance of the Canol Trail was performed in order to compile a complete inventory of abandoned/waste materials, identify potential areas of contamination and develop a logistics plan for future assessment. Ground-based reconnaissance of the Canol Trail was performed by all-terrain vehicle. By the end of the 2008 field season, over 80% of the Canol Trail (approximately 304 of the 368 kilometre road) had been covered by ground. The portion not examined by ground lay between Road Mile Post 40 (top of Dodo Canyon) and Pump Station #1 on the Mackenzie River (across from Norman Wells). The majority of offshoot or false start trails/roads were examined through aerial reconnaissance. Aerial investigations of Pump Stations #4, #5 and #6 and the road maintenance camp at RMP 222 were not completed in 2008 due to poor weather.

The pump stations and road maintenance camps represent the greatest perceived risk to the environment and human health and safety. These areas contain a variety of contaminant issues and physical hazards.

The main health, safety and environmental problems that were identified can be summarized as follows:

- Physical debris comprising primarily of dilapidated, collapsed, or burnt buildings, drums, telephone line, abandon pipeline, dilapidated or collapsed bridges and abandoned vehicles;
- Asbestos present in some buildings;
- Oil storage and separator tanks with residual contents (both underground and above ground);
- Drums (approximately 5000 empty and 80 with contents);
- Soil contaminated with polycyclic aromatic hydrocarbons and petroleum hydrocarbons;
- Soil contaminated with inorganic elements;
- Potential lead containing paint for all painted equipment, materials and buildings; and
- Hazardous fluids and materials associated with abandoned vehicles.

Reconnaissance findings were used to select sites for Phase II Environmental Site Assessments in the 2009 field season.

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Region(s): IN

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Location: Kendall Island Bird Sanctuary

Relations Between Ground Ice and Geomorphic Setting, Kendall Island Bird Sanctuary, Mackenzie Delta, Northwest Territories

The purpose of this project was to determine if the proportion of near-surface ground ice made up by ice wedges is less in wetlands than uplands of Kendall Island Bird Sanctuary. The specific field objective in 2008 was determining the geometry of ice-wedges in uplands and lowlands by shallow drilling. To date, twenty-seven ice wedges have been examined in detail. Maximum width of wedge-ice in the upper meter of permafrost at wetlands ranged between 30 centimetres to about 140 centimetres, but most ice-wedges were about 70 centimetres wide at maximum. Many of these syngenetic-type wedges showed signs of recent cracking and at one location a vein of ice in the still-frozen active layer that extended from the top of the wedge was observed. Also documented was the subtle relief of the displaced ground above some syngenetic wedges with differential GSP, and described the difference in vegetation that was associated with this change in micro relief. These findings contrast with upland ice wedges where wedges are between 3 to 5 metres wide near the top of permafrost, and significant ridges and troughs were typically associated with them.

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Location: Mason Bay area of Richards Island

Quaternary History of the Summer Island Area, Tuktoyaktuk Coastlands

The coastal bluffs of northern Richards Island provided a valuable record of environmental and climatic history that stretched back to at least 125 thousand years before present, when the climate was warmer than modern temperatures. Interpretation of this history therefore helped to place the current climate and environmental changes into a long-term perspective, and to determine the consequences of climate change and glaciation on the landscape and ecology of this sensitive tundra region.

Fieldwork in July 2008 near Mason Bay examined ice age sediments deposited by a river that was thought to have previously flowed from northern Yukon into the Arctic Ocean (the former Porcupine River). The sediments dated from a time when the Mackenzie River flowed eastwards towards Hudson Bay. The river sediments contained glacially-sculpted stones that indicate a period of glaciation that was older than the most recent glaciation of Richards Island by Canada's last great ice sheet. In other words, this was new evidence for glacial ice in the Yukon or Northwest Territories sometime before about 25 thousand years ago.

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License Number: 14325

Location: Mackenzie Delta at North Point, Lousy Point and Williams Island

Active Layer Monitoring Network in the Mackenzie Valley – Snow Monitoring Component

During early April 2008, snowpack was measured at five Circumpolar Active Layer Monitoring grids in the Mackenzie Delta. These sites were part of the Circumpolar Active Layer Monitoring program of the International Permafrost Association.

Active layer thickness varied more as a result of local factors, related to situation, than from regional climate. Though both air and ground thawing degree days increased from Arctic through Sub-arctic to Boreal environments, final active layer was surprisingly similar, except where local factors override regional patterns. One important factor that could vary from year to year as well as from site to site was snow cover. Delta region grid sites could be divided into tundra and delta environments. Snow on the delta sites is deeper and generally softer than the thin, wind packed tundra snow, providing more insulation from winter cold yet removed quickly by the spring flood. 2008 snow everywhere but Lousy Point was intermediate in depth between deeper 2006 and thinner 2007. Lousy snow pack was thinnest in 2008. Density of the components of the snow pack did not vary much over the three years. In the longterm, measurements from these sites will be used to help model climate change impact on near surface permafrost in this fragile environment.

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Region(s): IN, GW, SA, DC

Licence Number: 14393

Location: At 60 sites from Fort Simpson to Tuktoyaktuk (coordinates are on file).

Active Layer Monitoring Network in the Mackenzie Valley

During August and September 2008, the 18th annual survey of the active layer monitoring system in the Mackenzie Valley was completed from Fort Simpson to the Arctic coast. Sites now number 49, about half in the Mackenzie

Delta. Ten have been selected for the Circumpolar Active Layer Monitoring program of the International Permafrost Association.

Along this 1400 kilometres transect, active layer thickness varies more as a result of local factors, related to situation, than from regional climate. Though both air and ground thawing degree days increase from Arctic through Sub-arctic to Boreal environments, final active layer is surprisingly similar, except where local factors override regional patterns. The thaw of 1998 was generally the deepest yet recorded, in keeping with record warm temperatures, though at a few sites it was exceeded in warm 2006 and 2007. 2006 was the warmest year thus far this century and thaw reflected this at almost every site. The widespread response to these events builds confidence in the utility of the instrumentation for measuring response in the ground to atmospheric change. In the longterm, measurements from this transect will be used to help model climate change impact on near surface permafrost in this fragile environment.

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File Number: 12 404 701
Region(s): SA

Licence Number: 14414
Location: Golden Deposit (located 54 kilometres northeast of Tulita)

Oxidation Processes and the Preservation of Organic Biosignatures in a Permafrost Dominated Environment – A Martian Analogue in the Canadian Arctic

The Golden Deposit was visible from the air as an approximately 125 by 50 metre golden-yellow patch of un-vegetated soil. It consisted of yellow ochre precipitating from a seep of acidic groundwater. The deposit was jarositic, contained within permafrost, and on the surface appeared as interlocking polygons, with acidic waters flowing from seeps in troughs between polygons. This site was of particular interest because it provided clues to the conditions of formation of similar deposits on Mars.

A field team sampled soil and water, and learned that water pH varied significantly over short distances depending on proximity to acid seeps, and that jarositic muds extended beneath the vegetation for 40 metres around the deposit, indicating that the system had been active for a long time. Mineralogy was determined through two laboratory techniques.

The research team demonstrated that geochemical heterogeneity at the sub-meter scales can exist at a seemingly homogeneous deposit, and indicated that there was much yet to be discovered at similar sites on Mars.

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File Number: 12 404 640
Region(s): IN, GW

Licence Number: 14329
Location: 30 sites in the central and western Mackenzie Delta and east of the Delta around Noell Lake

Environmental Change in the 20th Century, Mackenzie Delta Region, Northwest Territories

In the summer of 2008, two research projects were carried out in the Mackenzie Delta under the broad umbrella of Environmental Change in the 20th century. The first project examined the climatic controls of tree growth at northern treeline using tree core samples from white spruce at 21 sites in the Mackenzie Delta and the Campbell Dolomite upland. Tree cores were collected from living trees and disks/cookies were collected from dead trees lying on the ground.

The other aspect of the research programme involved the collection of lake sediment cores and water samples from ten lakes near Noell Lake. Surface sediment cores (approximately 20 to 60 centimetres in length) were collected from two types of lakes; ones where the shoreline was stable and ones where the shoreline was eroding because the permafrost was melting. These were analysed to determine: 1) the types of diatom communities that grow in each of the lakes; and (2) the impact of thaw slumps on lake ecosystems. Analysis of charcoal contained in the sediment cores was also conducted. Several of the cores were dated using 210-Pb method.

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File Number: 12 404 635**Licence Number:** 14293**Region(s):** IN**Location:** 66 lakes located north of Inuvik**Sensitivities of High-Latitude Lakes to Climatic and Development Disturbances**

The fourth year of sampling was completed in 2008. The research aim was to understand the effects of permafrost degradation on the supply of nutrients to and biological communities of, tundra lakes.

Water quality, biological and isotope sampling was completed at a pair of lakes (one with permafrost shoreline degradation; one undisturbed). Chemical and physical water sampling was also performed along with biomass (algal and bacterial) sampling including the collection of phytoplankton, bacterioplankton and zooplankton at the two lakes. Water samples were collected from 24 paired lakes over a climatic (latitudinal) gradient from Inuvik to Richards Island for geochemical and isotopic analysis.

Prior to freeze-up, the two lakes were again sampled for water chemistry, phytoplankton, bacterioplankton, zooplankton and benthos. Water samples were also gathered from the 24 paired lakes.

Preliminary analyses indicate: 1) water chemistry impacts of permafrost degradation determined the limiting factors for phytoplankton growth at lake sites (bottom-up control on food web structure/productivity); and 2) some of the small pond/lake food webs may have included very small fish, such as stickleback (top-down control on the food web structure/productivity).

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**File Number:** 12 404 635**Licence Number:** 14294**Region(s):** IN, GW**Location:** Known ice jamming and flooding sites and at hydrometric stations downstream of Arctic Red**Evaluation of Extreme Events (Ice Jams) and Deep Scour Holes on Mackenzie Delta Channels**

The objective of this study was to: 1) quantify the frequency and magnitude of ice jams in the Mackenzie River Delta; 2) the hydroclimatic conditions controlling the occurrence of ice jams and associated floods; 3) to develop a hydraulic model of ice jamming for the Mackenzie Delta and 4) to investigate the importance of deep scour holes in the Mackenzie River.

Results of this work included the creation of a breakup chronology in the Mackenzie Delta over the period of instrumental record. Peak water levels, and breakup timing and duration gathered for hydrometric stations throughout the delta over the period 1974 to 2006 allowed the investigation of spatial and temporal patterns of breakup. For the most severe breakup flooding, two event types were identified: ice-driven events, in which ice jamming results in high peak levels in the southern delta and eastern and western regions, and discharge-driven events, with the highest peak flow arriving from the Mackenzie River, resulting in highest relative peak water levels in the mid and outer delta and along Middle Channel. Break-up occurred earlier during ice events, and later during discharge events. Conditions linked with different breakups were investigated, showing the severity of breakup water levels is most influenced by Mackenzie River discharge and the progression of spring melt through the basin. A trend toward a longer melt period prior to breakup was noted.

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Licence Number: 14307
Location: Scotty Creek

Stream Flow Generation in Wetland-Dominated Zones of Discontinuous Permafrost

The long term objective of this research is to reduce the uncertainty of the impact of climate warming on the future availability of the NWT fresh water resources. Much of this uncertainty is due to unprecedented warming and human disturbance in the zone of discontinuous permafrost which has led to substantial permafrost melt in recent years. This has the potential to greatly alter the nature of water cycling within, and the volume and timing of runoff from the wetland-dominated drainage basins that characterise much of the discontinuous permafrost zone in the NWT and elsewhere.

The research at Scotty Creek strongly suggests that permafrost loss has the potential to alter the volume and timing of streamflow, as well as affect the quality of stream water (e.g. the amount of sediments, pollutants nutrients and organisms within streams). The uncertainty regarding the mechanisms and rates of permafrost melt, the impact of this melt on water drainage and storage patterns and processes, and appropriate mitigation strategies, emphasizes the need for sound scientific research to provide the knowledge base required for informed and sustainable management of this resource. In response to this need, this research project has begun to develop a suite of computer models for predicting the response of discontinuous permafrost to climate warming and human disturbance from oil and gas exploration and the consequent change in landcover and river flow regime in the lower Liard River valley. This is being achieved by meeting the following activities: 1) mapping the spatial distribution of permafrost and its change over the past 50 years using aerial photography and satellite images; 2) developing new conceptual and mathematical models of hydrological processes; 3) developing a new permafrost model including the effects of human-induced disturbances; and 4) combining the hydrological model with the permafrost model to predict the spatial distribution of permafrost and the river flow regime under possible scenarios of climate change and human-induced disturbances.

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Region(s): IN

Licence Number: 14418
Location: Near Paulatuk

Darnley Bay Resources Limited Summer Field Program 2008

No research was pursued under this NWT Scientific Research Licence.

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File Number: 12 404 688
Region(s): IN

Licence Number: 14310
Location: A 21 kilometres line on the Beaufort Sea Ice west of Tuktoyaktuk

GXT 2008 Marine Vibroseis Research Project (Flex Wave Test)

Many people in the NWT are familiar with vibroseis technology for conducting seismic surveys on land. This typically involves several large vibrator trucks that "thump" the ground near lines of sensors (receiver cables) that are laid out to record the sound vibrations. However, this method is not often used on floating sea ice, mainly because strong noise interference is created when the vibrated ice moves, produced by a "flex wave." This interference can be strong enough to block out the signal generated by the vibroseis equipment.

Some methods used to overcome this problem (e.g. using dynamite on the sea floor or making a cut in the ice between the vibrators and the sensors) have not been practical for environmental or cost reasons. Other conventional approaches using special processing of the data have not been very successful in eliminating the unwanted noise.

The purpose of GX Technology's 2008 Beaufort Sea research project was to conduct an on-ice vibroseis survey using special sensors developed by parent company ION and a new analysis approach to estimate and remove the flex wave interference. GXT began mobilizing its project from its Tuktoyatuk base camp. 21 kilometre of its planned survey was completed. Initial analysis of the data has shown success in the removal of flex waves from the data set acquired. External to the scope of the test GXT identified unexpected secondary imaging challenges related to the very shallow free water under the survey area ice pack that GXT continues to focus on.

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File Number: 12 404 690
Region(s): SA

Licence Number: 14328
Location: Great Bear Lake

Modelling Temperature and Heat Fluxes of Great Bear Lake

The objectives of this research include: 1) to conduct observations on Great Bear Lake to measure meteorology, heat fluxes and physical limnological components; 2) to model the thermal structure of Great Bear Lake under current climate and climate changed conditions; 3) to quantify the variability in the meteorological, heat flux and limnological characteristics of Great Bear Lake based on 2004-2009 observations; and 4) to assess the effect of climate on the temperature structure and heat fluxes of Great Bear Lake.

This research program represents the most intensive physical program ever conducted on the lake. In 2008, a ship was used to deploy a meteorological station on Lionel Island and a series of moorings in the Keith Arm to measure lake temperature, water movement and light transmission. In situ year-round temperature moorings were deployed at the mouth of the Smith-Dease Arm, at the mouth of the Keith Arm and in the McTavish Arm. Also deployed were 3 APEX temperature profilers in the same locations which were programmed to transmit temperature profile observations via ARGOS satellite during the ice-free period. The summer observations in the Keith Arm were retrieved at the end of September. It is expected that the year-round observation platforms will continue to operate through winter 2008-09 with sufficient battery power to record critical data well into year 2009.

Meteorological, radiation, temperature, current and light transmissometer data collected in 2008 have completed pre-processing and are archived using standards developed over 30+ years at the National Water Research Institute

Modelling of the thermal structure and currents of Great Bear Lake required the development of a computer-based 2 x 2 kilometres grid bathymetry. This task is nearly completed and includes depth soundings from Hydrographic Chart 6390 augmented by depth soundings taken from survey track plots from the Debra Lynn vessel during instrument deployment.

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File Number: 12 402 801
Region(s): DC

Licence Number: 14396
Location: Numerous sites along the streams and rivers in the South Nahanni Watershed

Quantifying the Effects of Mining Activities on the Health of Streams in the South Nahanni Watershed (NWT)

The objective of work completed in 2008 study was to collect samples of water, benthic invertebrates and benthic algae that, following analyses, would be used to assess the effects of mining activities on the health of streams in the South Nahanni Watershed.

In 2008, the researchers collected samples of water, benthic invertebrates and algae from 73 stream sites located throughout the entire South Nahanni Watershed. These sites included those located immediately upstream and

downstream of mining activities on the Flat River (Canadian Tungsten's Cantung mine) and in Prairie Creek (i.e., Canadian Zinc exploration mine).

The final report is scheduled for completion by October 2009. This report will provide resource and land managers with a baseline description of current conditions in the South Nahanni Watershed, allow them to assess the effects of mining activities on stream health, and to develop a long-term program to monitor the ecological health of streams in the South Nahanni Watershed following continued mining or the establishment of new mines.

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File Number: 12 404 691

Licence Number: 14330

Region(s): IN

Location: Mallik L-38 site on the western side of Richards Island

Mallik 2L-38 and 3L/4L/5L-38 Sump Monitoring and Retrofit Program

Research activities were carried out to document the physical conditions of two drilling waste sumps at the Mallik site in the outer Mackenzie Delta. Three primary field tasks were conducted: 1) active layer depth in both disturbed (sumps) and undisturbed areas were measured; 2) near-surface (upper 1-1.5 metre) and deeper (1-6 metre) electromagnetic surveys were conducted to measure the conductivity of the sediments in and around the sumps; and 3) air and ground temperature data loggers installed the previous year were downloaded and re-launched for data collection in the coming year.

As this is the first year that data were collected in a systematic way following the Protocol for the Monitoring of Drilling-Waste Disposal Sumps, researchers consider this to be the baseline study to which data collected in subsequent years may be compared to assess the over-all engineering performance of the sumps. The data will be reported to the Northwest Territories Water Board and integrated into their electronic database.

In late-August, collection of native seeds took place at the Mallik site. Seed was collected from eleven plant species and will be used in future revegetation trials at the Mallik site.

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Region(s): NS, SS

Location: Within and adjacent to the Thor Lake property

2008 Baseline Studies for Avalon Ventures Ltd. proposed Thor Lake Rare Earth Metals Project (Terrain component)

Researchers completed the first year of baseline studies for soil, terrain and permafrost at Avalon Rare Metals Thor Lake Project.

Soil and surficial geology was described at more than 60 locations. It was observed that surficial accumulations throughout the Thor Lake area are associated with erosion and deposition by ice during the last ice age. Soil was collected for laboratory analysis at more than 20 locations and three main soil types were identified: regosols, brunisols (both poorly developed soil) and cryosols (soil related to permafrost). A hand held drilling machine was used to drill six shallow holes to an average depth of 2.5 metres. The size of the ground layer which freezes and thaws every year (the active layer) was measured in all drilled holes. Active layer size ranged from 40 centimetres (usually in wetlands), to 50 – 80 centimetres in forests, to 1.5 – 2.5 metres in forests with good drainage.

Samples of permafrost (frozen ground) were collected in all drill holes to determine how much ice was present. It was observed that permafrost samples were very ice-rich, with more ice than sediment in the samples.

The second year of the baseline studies for soil, terrain and permafrost will continue in 2010.

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File Number: 12 404 703**Region(s):** NS, SS**Licence Number:** 14423**Location:** Within and adjacent to the Thor Lake property**2008 Baseline Studies for Avalon Ventures Ltd. proposed Thor Lake Rare Earth Metals Project (Aquatics and Hydrology component)**

Researchers completed the first year of baseline studies for aquatics and hydrology at Avalon Rare Metals Thor Lake Project.

Water samples were collected from 20 stations in 18 lakes and samples were analyzed for general water chemistry, metals and radionuclides. Surface water hydrology examinations involved installing two lake level gauges and five stream gauges to determine the amount of water leaving or entering a lake or stream and the collection of local weather data from on-site weather station.

Four wells to monitor groundwater were installed and three drill holes (from Avalon's exploration drill program) were left unplugged to monitor deep groundwater. This monitoring included: determining depth to water; groundwater flow direction; and calculating groundwater flow speed. Groundwater was also sampled in three wells to analyze for general water chemistry and metals

Year two of the baseline studies for aquatics and hydrology will continue in 2009.

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File Number: 12 404 657**Region(s):** SA, DC, GW**Licence Number:** 14391**Location:** 29 active layer and permafrost temperature monitoring sites along the Mackenzie Valley**Permafrost Monitoring and Collection of Baseline Terrain Information in Mackenzie Valley Corridor, NWT**

The three main goals of this research are: 1) to provide baseline knowledge of permafrost and terrain conditions (specifically ground temperature) and improve characterization of terrain sensitivity in the Mackenzie Valley; 2) monitor ground temperature and active layer to detect changes in permafrost conditions resulting from surface disturbance or climate change and to improve prediction of future response; 3) provide information which contributes to environmental impact assessment and mitigation of northern development, land use planning and to climate change assessments.

Field activities in 2008 largely involved the acquisition of ground temperature data from monitoring sites established in 2007 in the Mackenzie Corridor. Temperature data were acquired from data loggers connected to temperature cables installed in 32 boreholes in the Deh Cho, Sahtu and Gwich'in Settlement Areas. Generally site visits lasted less than 20 minutes. In addition, temperature cables were installed in 8 boreholes, all less than 10 metres deep, drilled in the Gwich'in in 2007. For most boreholes, a continuous record of ground temperatures at least one year in length is now available which allows a characterization of baseline permafrost conditions which may be utilized for land use planning. Long-term maintenance of monitoring sites with continued data collection is planned in order to better characterize the changes in permafrost conditions and the impact of climate change.

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Location: Inuvik - Lot 8, Plan 50540, Group 1355

PolarDARN - The Northern Hemisphere Polar Portion of the International SuperDARN (Super Dual Auroral Radar Network) Program

The year 2008 has been a landmark in the SuperDARN community because it was the first full year in which both PolarDARN radars were in operation. This radar network was designed to measure voltage patterns several hundred kilometers above the ground, as these patterns project out into space along the Earth's magnetic field lines. What is remarkable about these PolarDARN radars is that, in spite of having been turned on during the minimum of Solar Cycle 23 when HF radar propagation conditions are usually at their worst, the radar echo occurrence for these radars has been high, better than the other 11 northern hemisphere and the 8 southern hemisphere SuperDARN radars. The results show that the "polar cap region" into which the PolarDARN radars look is very dynamic even when solar activity is not. This would appear to confirm that the high-latitude location of the PolarDARN radars is ideal. The reason for this is that the magnetosphere, the magnetic region surrounding the Earth, is set in motion by an important astrophysical process called magnetic reconnection, which occurs in space at the boundary between the "open" and "closed" magnetic field lines of the earth. That boundary, called the open-closed-field-line-boundary (OCFLB), maps down to the equatorward edge of the polar cap region that the PolarDARN radars examine. During the relatively "quiet" conditions during 2006, 2007 and 2008, OCFLB boundary has been located frequently at the high latitudes that are examined by the PolarDARN radars.

New Solar Sunspot Cycle 24 was supposed to begin in 2008, but the Sun's sunspot activity has been surprisingly low. In October, there were 5 new sunspots, of which four had the correct magnetic polarity for Cycle 24 (~2008 – 2017). None of these sunspots were strong, and during November and December, there were again no sunspots. This lack of sunspot activity is of great interest, because there were already predictions that Cycle 25 (~2018-2029) would be weak. In the 66-year period 1645 – 1711, which spanned six 11-year sunspot cycles and was called the "Maunder Minimum", the cycles became very weak. During the Maunder Minimum, the solar wind from the Sun became weak and carried a much reduced magnetic field. The results were dramatic, particularly as seen in tree-rings. They became thin because the weather was much colder than normal, so cold that this period was nicknamed the "Little Ice Age". Also, the solar wind magnetic field protects the Earth from very energetic "galactic cosmic ray particles", so this protection was reduced. Therefore, the cosmic rays penetrated into the atmosphere and produced radioactive Carbon-14 whose decay fragments are clearly seen in the tree rings.

Researchers continue to use these data to study the input of energy from the weak solar wind into the Earth's magnetosphere, and the possible relationships to the weather. The winter of 2008 and extending into 2009 is showing indications of being one of the coldest in years.

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Region(s): IN

Licence Number: 14290

Location: The Mackenzie Delta

Geological Conditions Affecting Industrial and Community Development in the Coastal and Nearshore Regions of the Western Canadian Arctic

During the past year researchers have investigated the Mackenzie Delta and nearby shallow nearshore regions throughout the year. Spring breakup in 2008 was characterized by ice jams and very high water in some places, but no severe flooding in the delta communities. The progress of breakup in the delta and offshore was documented and distributed to interested organizations by a daily newsletter. In the nearshore, overflow onto the sea ice was measured using satellite images and instruments mounted on the sea ice and the resulting drainage through the ice onto the seabed was observed to scour the bed to a depth of more than 1.5 metres. Currents and waves were measured and the seabed was mapped during the summer field season in order to find out how the sediment is

redistributed. Detailed surface elevation over the outer delta was measured using airborne mapping. Subsidence of the delta was also measured using very accurate GPS equipment. In the winter, researchers used the ice as a platform to recover information about the temperature of the seabed and where permafrost may occur under the ocean. This information is being used to support sustainable resource development and environmental conservation decisions in the western Arctic.

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Region(s): NS

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Location: Baker Creek basin, with a spring melt and summer camp at Vital Lake

Investigations of the Water Cycle and Hydrological Processes of the Subarctic Canadian Shield

Field activities in 2008 in the Baker Creek research catchment began with spring snow surveys and the activation of climate towers and water level stations. Measurements of the water tables, soil moisture and streamflow and water samples for stable isotope and ionic analysis were collected. Satellite imagery were taken and classified in an attempt to measure how the extent of saturated surface areas changes during the spring and summer. Notable results from 2008 include the discovery that saturated areas in wetlands tend to be those areas with the deepest frost tables. This is because of coincident mass and heat transfers as water enters the wetlands from bedrock uplands or upstream lakes. Observed water budget data implies that much of the catchment experiences an increasing lack of storage due to evaporative losses through the summer. This detaches most of the watershed from the channel in all but the wettest situations. It has been found that the efficiency with which the catchment can convert storage into runoff decreases with drying conditions. The runoff response of the catchment to rainfall depends on how efficient the watershed is behaving immediately before the event and which areas are available to produce runoff and route it to the channel. Work on a framework to quantify this process by relating it to connectivity and storage is in progress. Water budget and hydrological process studies will continue in 2009 and address this question in particular.

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Region(s): IN, GW, NS

Licence Number: 14317

Location: In the region 100 kilometres north, south & southwest of Inuvik (with flights going also 200 kilometres east of Inuvik) and Daring Lake Tundra Ecosystem Research Station

Variability and Change in the Canadian Cryosphere - Tundra Information Transferability Study

The objectives of this research is to measure snow depth, snow density and snow water equivalent (water storage in the snowpack), as well as lake ice thickness and structure for comparison with microwave radiometer measurements. Environment Canada led and collaborated with other International Polar Year investigators in two field campaigns to develop new methods of estimating snow water equivalent (SWE) in a tundra environment using satellite passive microwave data. Airborne microwave remote sensing flights and field measurements of snow cover and lake ice properties were conducted in the vicinity of the Daring Lake Tundra Ecosystem Research Station.

The successful completion of these NWT sub-arctic IPY field campaigns has resulted in the acquisition of hundreds of kilometres of high resolution airborne microwave radiometer data with over 85 kilometres of continuous snow depth measurements (measured at 2 -10 metres intervals) and over 200 ice thickness measurements recorded along radiometer flight lines. These flight lines cover boreal forest, taiga and tundra environments. In addition to the microwave radiometer, a video recording and surface temperatures were measured simultaneously by aircraft instrumentation. Such extensive and detailed surface measurements coupled with high resolution airborne microwave radiometer data have never been acquired. Most of the snow survey data have been post-processed and assessed for quality-control. The airborne microwave data sets are still under-going post-processing and calibration. The snow survey data is currently in the process of being linked to detailed terrain and land cover information for each of the study sites. Preliminary analysis of the in situ data has started with early results showing strong relations between land cover and snow properties.

Metadata for the data sets acquired during these campaigns has been submitted to the IPY Polar Data Catalogue. All data will eventually reside in this database (www.polardata.ca).

Wang, Baolin

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File Number: 12 404 658

Licence Number: 14291

Region(s): GW

Location: 50 kilometres diameter area around Travaillant Lake

Mackenzie Valley Landslide Geotechnical Investigations

The objective of this research was to better understand slope failure and movement mechanisms in the region. The work in 2008 mainly involved surveys of movement rates of several active landslides near Travaillant Lake. Some soil samples were taken from the landslide scarps for geotechnical property testing. The instruments installed in 2006 at an active landslide site about 5.5 kilometres southeast of Travaillant Lake (N 67° 40' W 131° 31.8') were monitored as an ongoing process. The two test plots developed in 2007 were instrumented in 2008 to monitor ground condition changes including: temperatures; water pressures; and slope movements but were destroyed by wildlife before the winter of 2008. The site will be cleaned up in 2009 after the ground thaws.

Wang, Baolin

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File Number: 12 404 658

Licence Number: 14292

Region(s): IN

Location: 15 kilometres north of Inuvik to the Beaufort Sea

Mackenzie Valley Landslide Geotechnical Investigations

The objective of the project was to better understand slope failure mechanisms and landslide movement behaviours. In 2008, several landslides north of Inuvik were surveyed. Small soil samples were taken by hand from the landslide scarp walls to determine soil geotechnical characteristics. The team continued their monitoring of the test plot that was developed in 2005 next to an active landslide at the East Round Lake (N68°41.3' W133°54.1'). The monitoring equipments were destroyed by wildlife and lightening before winter started. The test site will be cleaned up in 2009 (after snow melt).



Photo Credit: ARI Archives

Traditional Knowledge

Balanoff, Helen

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File Number: 12 410 617
Region(s): IN

Licence Number: 14299
Location: Ulukhaktok

Pitquhiraluavut Puiglimiatavut (We will not forget our ways): Bringing Home Photographs of the Inuinait Collection at the British Museum

During 2008, the researcher, with help from staff at the British Museum, developed a complete inventory of Inuinait objects stored at the British Museum. She visited the British Museum in May and finished taking working photographs of the objects. The photos were categorized according to the source of the objects.

From the working photos, three Elders and apprentice selected the objects they wanted to have high resolution photos of, as well as different angles of sections of the objects they wanted to see more closely. The principal investigator ordered the high resolution photos from the British Museum.

At the same time, a company was contracted to develop the database of objects, using the working photos and the existing description from the British Museum database. Staff from the company met with staff from the British Museum to determine a common format. The database is in the process of being finalized and is currently on a staging site.

Bayha, Janet

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File Number: 12 410 548
Region(s): SA

Licence Number: 14380
Location: Tulita and Norman Wells

Traditional Knowledge Studies

No research was pursued under this NWT Scientific Research Licence.

Edge, Lois

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File Number: 12 410 807

Region(s): GW, SS

Licence Number: 14410

Location: Fort McPherson and Fort Smith

Indigenous Women, Ways of Knowing, and Aesthetic of Beadwork

This study examined the participation of Indigenous women in traditional cultural activities, such as beadwork, and their contribution to individual development, identity formation, establishment of teacher/learner relationships, social and cultural environments. During 2008, a bi-weekly urban Aboriginal Women's Beading Circle was facilitated in Edmonton to document women's perspectives during beadwork. In 2007, a visit was made to the Pitt Rivers Museum, University of Oxford, to explore historical context and cultural meaning as represented in a pair of moccasins made by the researcher's grandmother, Joanne Edge, at Fort Smith, Northwest Territories, and purchased by the Hudson Bay Company in 1942. The final phase of this research will be conducting interviews with elderly women about beadwork in Alberta and the Northwest Territories, which will be completed during 2009. Research outcomes were shared through a series of digital stories. This study drew attention to the many contributions of First Nations and Métis women in the sub-arctic regions of northern Canada whose legacy was a rich endowment of materials created and crafted by them from which current and future generations continued to learn about Indigenous ways of being. Analysis and reflection upon Indigenous ways of knowing contributed to understanding of Indigenous women's identity, lifelong learning and the health and wellness of Aboriginal people in Canada.

Grieve, Sheryl

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File Number: 12 410 707

Region(s): NS

Licence Number: 14362

Location: Bathurst caribou herd range

Climate Change Impacts on Canadian Arctic Tundra Ecosystems - Métis Traditional Knowledge Study

As a part of a larger International Polar Year project entitled "Climate change impacts on Canadian Arctic tundra ecosystem," the North Slave Métis Alliance visited three tundra locations (Artillery Lake, Aylmer Lake and Yamba Lake) to collect both scientific and traditional observations of the state of the vegetation, terrain and climate in the North Slave region. Scientists conducted scientific sampling of vegetation and soils to provide baseline data to contribute to government and academic research partners, while elders contributed traditional knowledge on the sampling techniques and observations on the changing environment. Preliminary results indicated a general warming and drying trend for tundra soils and vegetation, with concurrent changes in plant, insect and other animal behaviors. Bringing together these two forms of knowledge, the goal of the research was to better understand the changes that have occurred and to assist the North Slave Métis People in preparing for changes that are soon to come.

Lambert Koizumi, Catherine

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File Number: 12 402 790

Region(s): IN, GW

Licence Number: 14370

Location: Aklavik, Fort McPherson, Inuvik and Tsiigehtchic

Traditional Ecological Knowledge of Dall Sheep, Grizzly Bears and Wolves in the Richardson Mountains

Dall sheep (*Ovis dalli dalli*) in the Richardson Mountains form a small population related to grizzly bear (*Ursus arctos*) and wolf (*Canis lupus*) predation. Understanding of population dynamics, habitat use, behaviour, predator-prey relationships and natural history of these three species was improved by documenting local and traditional ecological knowledge of Gwich'in and Inuvialuit People, who have inhabited the region for generations. The interviewees were selected in collaboration with the local renewable resource councils. Twenty-three elders or hunters from Aklavik and Fort McPherson were interviewed on their knowledge about Dall sheep, grizzly bears and wolves. An assistant from each community coordinated and recorded the interviews, which were transcribed during the fall of 2008.

Nesbitt, Lorien

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File Number: 12 410 821

Region(s): SA

Licence Number: 14354

Location: Déline

Edaiila Traditional Ecological Knowledge Study

The purpose of this research was to increase understanding of the ecology of Edaiila, particularly the role Edaiila plays in the life cycle of caribou and the persistence of caribou herds/populations. The traditional ecological knowledge of the elders of Déline was explored through personal interviews and a workshop.

The Déline elders identified five kinds of caribou that use Edaiila:

- Bluenose-East barren-ground caribou herd (*Rangifer tarandus groenlandicus*)
- Bathurst barren-ground caribou herd (*Rangifer tarandus groenlandicus*)
- "Edadee": very large male barren-ground caribou that never join the herd (*Rangifer tarandus groenlandicus*)
- Woodland caribou (*Rangifer tarandus caribou*)
- Dolphin-Union caribou population (*Rangifer tarandus groenlandicus*, sometimes called *Rangifer tarandus groenlandicus x pearyi*)

The Déline elders predicted that all caribou that use Edaiila would decline if Edaiila were developed or damaged. The elders advised that caribou are particularly sensitive to smells, noise, smoke, exhaust and airplane, helicopter and skidoo use.

This report represents a preliminary exploration of the Déline elders' traditional ecological knowledge and is the first step in the process to describe the ecology of Edaiila and present a rationale for its protection.

Pawluk, Rick

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File Number: 12 410 688

Region(s): SA

Licence Number: 14295

Location: Fort Good Hope

2008 Traditional Knowledge Study in Fort Good Hope

The Mackenzie Gas Project signed a contract in 2006 with Ne'Rahten Development, a business unit of the local land corporation in Fort Good Hope, to conduct a traditional knowledge study for the Mackenzie Gas Project. In 2007, the study was initiated with the purchase of necessary equipment, employment of a community resident as the community lead researcher and pre-existing data was reviewed. No data collection, compilation or analysis was conducted in 2007. The study was guided by community, Yamoga Land Corporation and NikPoint Environmental. The report was concluded in December 2009.

The Yamoga Land Corporation established a working group of knowledgeable community members to provide guidance and to determine the Traditional Knowledge subject areas, the levels of community participation and community members to be interviewed. The study documented information related to wildlife, birds, fisheries, vegetation, historical/cultural/spiritual sites, climates, soil conditions and movement, hydrology, insects and traditional foods.

The study and the Traditional Knowledge is the property of the community of Fort Good Hope. The confidential nature of the information is recognized by the Mackenzie Gas Project, as such MGP cannot release the information of the study report.

Schryer, Rick

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File Number: 12 410 828
Region(s): NS

Licence Number: 14406
Location: Behchokq, Gamèti, Whati, Wekweëti and Yellowknife

Traditional Knowledge and Traditional Land Use Studies for the Fortune Minerals NICO Cobalt-gold-bismuth Project (2008)

No fieldwork was pursued under this NWT Scientific Research Licence.

Simmons, Deborah

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File Number: 12 410 678
Region(s): SA

Licence Number: 14275
Location: Déline

The Words Of Our Ancestors Are Our Path To The Future: Mapping Dené Language, Narrative and Governance in Déline, NWT- Phase 2

This was a Déline Knowledge Project program sponsored by the Déline First Nation in partnership with the University of Manitoba. The program was initiated in 2006, with a focus on understanding the role of language and stories in governance. The foundation of the program has been establishment of a digital oral history archive. Activities in 2008 included an archiving workshop involving participation from various Déline organizations, as well as Fort Good Hope and Colville Lake; an assessment of language dynamics in the community through a series of language contests; and interviews with pre and post-natal mothers about their perspectives on Dené language and culture.

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File Number: 12 410 678
Region(s): SA

Licence Number: 14337
Location: Fort Good Hope and Colville Lake

K'asho Got'ine/Colville Lake Barren-Ground Caribou Traditional Knowledge Study

This project was part of a five year study with the communities of the Sahtu Region, sponsored by the Sahtu Renewable Resources Board in partnership with the University of Manitoba. The overall goal was to investigate the ways in which Dené and Métis people use traditional knowledge to understand and respond to changes in the environment, and act as ongoing stewards of the land. The study with Fort Good Hope and Colville Lake focusing on community relationships with the Bluenose West caribou herd has taken place over several years. Over the past year, collaboration with Fort Good Hope has continued, working with youth on a participatory video project with elders. There was a meeting, held in Colville Lake, with the Elders Council to review work to date and record new stories. In conjunction with this, a digital storytelling workshop was facilitated for students at the Colville Lake School, resulting in a documentary about the annual Horton Lake community caribou harvest (licensed separately).

Simmons, Deborah

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File Number: 12 410 678
Region(s): SA

Licence Number: 14395
Location: Tulita

Tulita Caribou Traditional Knowledge Study

This project is part of a five year study with the communities of the Sahtu Region, sponsored by the Sahtu Renewable Resources Board in partnership with the University of Manitoba. The overall goal is to investigate the ways in which Dené and Métis people use traditional knowledge to understand and respond to changes in the environment, and act as ongoing stewards of the land. The focus of this study was on people's relationship with mountain caribou in the Shúhtagot'ine Néné area. The Tulita study involved several components: a three day focus group with elders; a partnership with Chief Albert Wright School, the Tulita Dené Band, Tulita District Land Corporation and others in a caribou harvesting trip to Tedzexe (Drum Lake) (licensed separately); and establishing a network of researchers engaged in research related to caribou and communities in the Sahtu Region. Research in 2009-2010 will involve collaboration with the Norman Wells Land Corporation and Renewable Resources Council in an on-the-land project and a digital storytelling workshop with Mackenzie Mountain School.

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File Number: 12 410 830
Region(s): IN

Licence Number: 14416
Location: Sachs Harbour and Inuvik

Inuvialuit Perspectives of Polar Bear Population Health and Harvest Sustainability

No fieldwork was pursued under this NWT Scientific Research Licence.

Smith, Jennifer

Wildlife Management Advisory Council (North Slope)
PO Box 31539
Whitehorse, YK Y1A 6K8
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File Number: 12 410 834
Region(s): IN

Licence Number: 14441
Location: Aklavik

Porcupine Caribou Traditional Knowledge Study

Both scientific and traditional knowledge are important to caribou management, but unlike scientific knowledge, no comprehensive record of traditional knowledge for the Porcupine Caribou herd has been gathered to date. In recognition of the value of traditional knowledge, the Wildlife Management Advisory Council (North Slope) launched this Aklavik-based study.

The main objectives of the research were to:

- Learn about movement patterns, distribution, range, population trends, habitats and health of the Porcupine Caribou herd;
- Understand more about the relationships between caribou and the peoples of Aklavik;
- Establish a body of information that can provide a background or frame of reference to assess changes in the herd and peoples' use of caribou;
- Inform Wildlife Management Advisory Council (North Slope) educational materials and general management; and
- To inform development and implementation of the Porcupine Caribou harvest management plan and Porcupine Caribou Management Board educational materials.

Fourteen Inuvialuit and Gwich'in people were interviewed by a social science expert as well as community experts, through in-person semi-structured interviews. Various aspects of caribou ecology were made clear and much of the information garnered about the relationships between people and caribou will serve useful for young hunters in Aklavik, as well as wildlife managers. Findings demonstrate that the wider social and cultural contexts of caribou management will become increasingly important for managers of the herd to address.

Wray, Kristine

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File Number: 12 410 705

Region(s): GW

Licence Number: 14289

Location: Fort McPherson

Ways We Respect the Caribou: Hunting In Teetl'it Zheh

The objectives of this study were to: 1) document elder/hunter perceptions of caribou health and population; 2) document traditional practices for respecting caribou for comparison with government hunting regulations; and 3) to explore the use of traditional knowledge and scientific data by hunters in decision making about where, when and with whom to harvest. The researcher worked in Fort McPherson doing interviews with younger hunters as well as doing an elders verification workshop where research results were reviewed and the group gave feedback and confirmation. Data collection for this project was completed.

Preliminary research results suggested that many of the respondents in the community of Fort McPherson perceived the Porcupine caribou herd to be in decline. Perceptions about population status were mainly formed by local sources of information about caribou: a hunter's on-the-land observations, talking with other hunters about their observations and from elders. To a lesser extent did people access information from the Tetlit Gwich'in Renewable Resources Council, and people get the least information about caribou from the Porcupine Caribou Management Board or the Government of the Northwest Territories. Information from these sources mainly related to hunting safety and population census counts. Gwich'in knowledge with respect to "how to respect caribou" directed hunting behaviour. To a lesser extent did Government of the Northwest Territories and Porcupine Caribou Management Board "rules" like not hunting cows, also affect hunting behaviour.



Photo Credit: Annika Trimble, ARI

Wildlife Permits

Abernethy, David

Acting Environment Superintendent - Operations
BHP Billiton Diamonds Inc.
1102 4920 52nd Street
Yellowknife, NT X1A 3T1

Permit No.: 5662

Species: Caribou, grizzly bears, wolves, wolverines, falcons, upland breeding birds

Region(s): NS

Location: Area surrounding the EKATI Diamond Mine

Wildlife Effects Monitoring Program (WEMP)

The objective was to test impact predictions and efficacy of mitigation measures for caribou, grizzly bears, wolves, wolverine, upland breeding birds and raptors. Specifically, the program monitored the potential effects of certain of the following mine activities, depending on the species: potential collisions with vehicles, incidents involving aircraft, general disturbance from the mine, habitat loss, roads as potential barriers, incidents at the pits and the Long Lake Containment Facility, disturbance affecting activity level, reproduction, or den use and the mine attracting some species.

Armstrong, Terry

Biologist
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PO Box 900
Fort Smith, NT X0E 0P0

Permit No.: 5635

Species: Bison

Region(s): NS, DC

Location: Fort Providence and Behchokq

Mackenzie Wood Bison Population Monitoring Project

The objective was to do a census of the Mackenzie bison population. Annual composition surveys provided data which helped to detect changes in the ratio of breeding age males to females and calf survival as expressed in calf:cow and yearling:cow ratios.

Bartlett, John

Manager
DeBeers Canada Inc.
300 - 5102 50th Ave
Yellowknife, NT X1A 3S8

Permit No.: 5657

Species: Caribou, grizzly bears, wolves, wolverines falcons, waterfowl, upland birds

Region(s): SS

Location: Snap Lake Mine; nearest community is Łutsek'e

DeBeers Snap Lake Mine: 2008 Wildlife Effects Monitoring Program

The objective of this annual monitoring program was to obtain and determine annual variability of the following information in the study area: the relative abundance, distribution, group composition and behaviour of caribou; the relative activity of grizzly bears and wolverines; the presence and production of wolves and falcons nesting; and the density and species richness of waterfowl and upland birds.

Beaubier, Jessica

Canadian Wildlife Service
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Inuvik, NT X0E 0T0

Permit No.: 5579

Species: King Eiders

Region(s): IN

Location: Ulukhaktok**Community-based Monitoring of King Eider Body Condition as an Index of Population Health**

The objective of this study was to determine the relationship between eider body condition, population health and extent of open water available in the Beaufort Sea during spring migration. It also monitored the effects of changing ice conditions on eider population health, and engaged interested Ulukhaktok community members in a monitoring program.

Beaubier, Jessica

Canadian Wildlife Service
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Permit No.: 5586

Species: Red-throated Loon

Region(s): IN, GW

Location: Toker Point, Nuvorak Point, Atkinson Point, Western Husky

Lakes area (NWT); King Point area (Yukon)

The Red-throated Loon as an Indicator of Environmental Quality Project

The objective of this study was to detect the ecological effects of offshore oil and gas on the Beaufort Sea ecosystem. The study used red-throated loons as an indicator species by assessing productivity and population status pre, during and post offshore oil and gas development. The study also determined the status of red-throated loon populations and productivity in the Beaufort Sea area (controlling for annual differences in small mammal populations).

Branigan, Marsha

ENR - Inuvik Region
Bag Service #1
Inuvik, NT X0E 0T0

Permit No.: 5369

Species: Boreal Woodland Caribou

Region(s): GW

Location: Inuvik region**Ecology of Boreal Woodland Caribou in the Lower Mackenzie Valley, Northwest Territories**

The objective of this study was to estimate home range size and seasonal movements of adult caribou, and determine patterns of habitat use, including use of areas burned by wildfires or containing man-made linear features such as seismic lines. This study also obtained estimates of productivity, recruitment and survival, as well as map the relative probability of occurrence of boreal woodland caribou across the Gwich'in Settlement Area. The study will identify if there are important seasonal habitats that are limited in the Gwich'in Settlement Area.

Branigan, Marsha

ENR - Inuvik Region

Bag Service #1

Inuvik, NT X0E 0T0

Permit No.: 5373**Region(s):** IN**Species:** Barren ground caribou**Location:** Inuvik region**Monitoring of Cape Bathurst, Bluenose-West and Tuktoyaktuk Peninsula Barren-Ground Caribou**

The objective of this study was to obtain current estimates of the recruitment, productivity and fall composition for the Cape Bathurst and Bluenose-West caribou herds and caribou on the Tuktoyaktuk peninsula.

Branigan, Marsha

ENR - Inuvik Region

Bag Service #1

Inuvik, NT X0E 0T0

Permit No.: 5576**Region(s):** IN**Species:** Grizzly bear**Location:** Inuvialuit Settlement Region**Population Estimate Using DNA Darting for Grizzly Bears in the Inuvialuit Settlement Region, West of Delta Eastward**

The objectives of this study included: providing an accurate estimate of the grizzly bears living in the Inuvialuit Settlement Region in the area East of the Mackenzie Delta, collecting additional reproductive parameters for the population (litter size), and using the data from the study to model the sustainable harvest of grizzly bears. DNA biopsy darts were used for this project.

Branigan, Marsha

ENR - Inuvik Region

Bag Service #1

Inuvik, NT X0E 0T0

Permit No.: 5370**Region(s):** IN**Species:** Caribou**Location:** Inuvik region**Collaring of Bluenose-West, Cape Bathurst and Tuktoyaktuk Peninsula Caribou**

The objectives of this study included monitoring caribou movement and range use by GPS collars. Baseline data on movements, productivity, composition and recruitment was required to assess the impact of industry-related cumulative effects and monitor recovery of caribou herds. This is especially significant considering the oil and gas exploration activities that have occurred, and are anticipated to occur over the next decade, on the winter ranges of the Cape Bathurst and Bluenose-West caribou herds.

Branigan, Marsha

Manager, Wildlife Management

ENR - Inuvik Region

Bag service #1

Inuvik, NT X0E 0T0

Permit No.: 5589**Region(s):** IN**Species:** Caribou**Location:** Tuktoyaktuk, Paulatuk, Kugluktuk**2008 Delineation of Calving Grounds of Cape Bathurst, Bluenose-West and Tuktoyaktuk Peninsula Barren-Ground Caribou**

Due to concerns about declines in barren-ground caribou herds in the NWT and the importance expressed at the Caribou Summit to protect the calving grounds, ENR attempted to delineate the calving grounds of all herds in the NWT in the next two years. This was the second year of this initiative. Project objectives included: 1) delineation of the calving grounds for the Cape Bathurst and Bluenose-West Barren-ground caribou herds and caribou on the Tuktoyaktuk peninsula; and 2) cooperation on a North American- wide scale to look at snow melt/green-up in relationship to calving distribution.

Brunham, Wade

Northeast Territories Energy Corporation
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Permit No.: 5608

Region(s): SS

Species: Barren-ground caribou, moose, muskox, wolf, wolverine and lynx

Location: Taltson River hydro station to Cahcho Kue, Snap Lake, Diavik and Ekati. Ft. Smith and Łutsel'ke

Talston River Expansion Project

The objectives of this study were: 1) to conduct surveys to collect baseline wetland information; 2) to document current wildlife and wildlife habitats along the proposed transmission line route; 3) to predict how the project may impact wildlife; and 4) to engage community representatives in the project.

Carson, Rebecca

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Permit No.: 5610

Region(s): DC, NS

Species: Boreal forest birds

Location: Ft. Liard, Hay River and Yellowknife vicinities

Comparative Phylogeographic of Boreal Forest Birds

The objectives of this study were 1) to elucidate phylogeographic patterns among populations of boreal avifauna; 2) to conduct a comparative phylogeographic analysis of boreal bird species; and 3) to discern if those species track the biogeographical history of their habitat.

Cluff, Dean

Regional Biologist
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Yellowknife, NT X1A 2P9

Permit No.: 5666

Region(s): NS

Species: Wolf

Location: Central tundra region of the NWT; closest communities are Dettah/N'Dilo, Łutsel'Ke and Wekweti

Index of Abundance for Tundra-denning Wolves

The objectives of this research were 1) to determine den occupancy annually over a large set of known wolf den sites; 2) investigate wolf population response to changing caribou abundance; and 3) quantify den site fidelity. This research offered a way to monitor the status of wolves in the Bathurst caribou herd range. Because the wolf population size likely tracks caribou population size (but with a lag effect), trends in annual wolf numbers can help understand changes in caribou numbers. Similarly, monitoring litter sizes of wolves can indicate responses of wolves to changing prey densities. The long-term objectives of this study are to establish an annual relative abundance index for tundra wolves.

Croft, Bruno

Caribou Monitor Specialist
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Permit No.: 5658

Region(s): NS

Species: Barren-ground caribou

Location: Bathurst caribou late winter and fall range

Bathurst Caribou Health, Condition and Contaminants Monitoring

The objectives were 1) to collect information on the health, diseases and parasites of Bathurst caribou, 2) to assess current status and monitor trends over time; 3) to collect information on body condition of caribou during the fall, which can be used to assess nutritional status and predict pregnancy rates; to collect information on the presence of environmental contaminants in caribou, to assess current exposure and trends over time; and 4) to compare this information to previous information from the Bathurst caribou herd and other caribou herds across the north using a standardized protocol.

Croft, Bruno

Caribou Monitor Specialist
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Permit No.: 5659

Region(s): NS

Species: Barren-ground caribou

Location: Survey areas in the vicinity of Behchokò, Whati, Gamèti, Wekweèti, Detah and Łutselk'e

Monitoring the Bathurst Herd

The objectives of this project were: 1) to continue to acquire location data from currently deployed satellite collars; 2) to relate movements of satellite collared cows to ecological conditions; 3) to measure annual calf survival in March-April 2008 and compare herd trends; 4) to measure fall sex ratio in October 2008; to deploy up to 13 additional satellite collars on Bathurst female caribou; 5) to understand types of forage species used and if they change over winter; 6) to understand use of burned area, limiting effects of snow conditions and the role of density dependence in dictating movement of caribou and implications for long-term supply of winter range; and 7) to understand the potential role of predation risk in influencing caribou distribution.

Derocher, Andrew

Biologist
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CW 405 Dept of Biological Sciences
Edmonton, AB T6G 2E9

Permit No.: 5372

Region(s): IN, GW

Species: Polar Bear

Location: Southern Beaufort Sea

Populations and Sources of Recruitment in Polar Bears

Subadult and adult female polar bears with young were caught in the Southern Beaufort Sea and instrumented with GPS satellite transmitters. The purpose of the study was to monitor the movements and survival of young bears and adult females. This study collected data needed for the understanding of vulnerability to oil-spills, population delineation and survival rates of juveniles.

Derocher, Andrew

Biologist
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Permit No.: 5375

Region(s): IN, GW

Species: Grizzly bear

Location: Mackenzie Delta

Ecology of Grizzly Bears in the Mackenzie Delta Oil and Gas Development Area

This study was designed to provide baseline information on the population ecology of grizzly bears during pre-development phase, to describe the seasonal movements, distribution and seasonal patterns of habitat use and selection, of grizzly bears in the area of the Mackenzie Delta. Other objectives included: 1) developing models to assess the potential cumulative impacts of human activities on grizzly bears, 2) monitoring changes in grizzly bear habitat use and movement patterns during the initial and post stages of pipeline construction, 3) determining how activities related to oil and gas exploration may affects the normal movements and 4) assessing levels of risk to bears from increased human activities in the area. This study documented den habitat, created a den habitat map and tested the quality of models developed pre-development.

Dixon, Lynne

Canadian Wildlife Service
4999 98th Ave.
Room 200
Edmonton, AB T6B 2X3

Permit No.: 5577

Region(s): IN

Species: King Eiders

Location: Banks Island

Identification of Beaufort Sea Migration for Sea Ducks

The development of offshore oil production facilities is currently underway in important sea duck migration corridors along the Beaufort Sea coast, and more development is expected to occur. This study determined specific migration routes for declining western Canadian breeding populations of King Eiders, as well as document temporal and spatial relationships of migrating King Eiders to pack ice, islands, shorelines and other physical features of the Beaufort Sea. It also identified wintering, staging and molting areas and their affiliation with specific breeding areas. Data was collected via satellite transmitters, surgically implanted in the abdominal cavities of captured ducks.

Dockrill, Craig

Canadian Wildlife Service
PO Box 1939
Inuvik, NT X0E 0T0

Permit No.: 5578

Region(s): GW

Species: Forest Songbirds

Location: Gwich'in Settlement Area

Establishing Baseline Density and Diversity of Forest Birds in the Gwich'in Settlement Area

This study determined the species composition, relative abundance, patterns of occurrence and inter-point variance of breeding songbirds in the Gwich'in Settlement Area; this data filled the knowledge gap concerning forest birds throughout areas under or slated for future development in the Mackenzie Valley.

Dunford, Jesse

Gartner Lee Limited
Suite N195 - 3015 5th Ave. NE
Calgary, AB T2A 6T8

Permit No.: 5664

Region(s): NS

Species: Ungulates, carnivorous birds

Location: Izok lake area of the Kitikmeot region, Nunavut

Izok Project, Wildlife and Wildlife Habitat Baseline Studies, Zinifex Canada Inc.

This program was designed to gather environmental baseline data to support environmental assessment of the Izok Project, and to provide the information needed to develop a Project Proposal/Environmental Impact Statement for review by the Nunavut Impact Review Board. Aerial surveys were conducted to study ungulates (caribou, muskox, moose). Large carnivore (grizzly bear, wolf) locations and den sightings were recorded. Surveys were also conducted to study raptors and waterfowl.

Elliott, Millissa

York University
4700 Keele St.
Toronto, ON M3J 1P3

Permit No.: 5609

Region(s): IN, SA

Species: Grass (*Festuca* species)

Location: Inuvik, Norman Wells, Ft. Good Hope, Ft. Simpson

Impacts of Oil and Gas Activity on the Peoples in the Arctic Using a Multiple Securities Perspective (Grass-endophyte Interactions in Northern Regions)

Grass shoots were collected from various sites across the Northwest Territories. The objectives of this study were: 1) to determine the distribution, frequency and intensity of endophyte infection among collected grass tillers; and 2) to determine the patterns that may exist between endophyte infection and environmental or ecological factors.

English, Colleen

Diavik Diamond Mines Inc
PO Box 2498
5007 50th Ave.
Yellowknife, NT X1A 2P8

Permit No.: 5663

Species: Barren-ground caribou, grizzly bear, wolverine, raptors, waterfowl/shorebirds

Region(s): NS

Location: Diavik wildlife study area, centered around Lac de Gras

2008 Wildlife Monitoring Program for the Diavik Diamond Mine

The objectives of this program were to verify the accuracy of the predicted effects determined in the *Environmental Effects Report (Wildlife 1998)* and the *Comprehensive Study Report (June 1998)*, and to ensure that management and mitigation measures for wildlife and wildlife habitat are effective in preventing significant adverse impacts to wildlife. Aerial and ground-based surveys were conducted to observe species.

Ferguson, Carl

Wildlife Biologist/Pilot
US Fish & Wildlife Service
11510 American Holly Drive
Laurel, MD 20708-4002

Permit No.: 5665

Species: Duck species

Region(s): NS

Location: Stagg River delta, southeast of Behchokq

Western Canada Cooperative Waterfowl Banding Program - Stagg River Station

Preseason banding of mallards, northern pintails and all other waterfowl species was completed. Bait traps were used to capture the birds.

Fronczak, Dave

US Fish & Wildlife
1 Federal Drive, Room 501
Fort Snelling, MN 55111-4058

Permit No.: 4765

Species: Waterfowl

Region(s): DC

Location: Mills Lake

Western Canada Cooperative Waterfowl Banding Program

Preseason banding of mallards, northern pintails and all other waterfowl species was completed. Bait traps were used to capture the birds.

Hegel, Troy

Caribou Biologist
Yukon Department of Environment
PO Box 2703
Whitehorse, YT Y1A 2C6

Permit No.: 5611

Species: Caribou

Region(s): DC

Location: Greater Nahanni Ecosystem

Greater Nahanni Mountain Caribou Population Monitoring Project

The objectives of this project were to complete fall composition surveys of the South Nahanni and Coal River heads, and to collar thirty South Nahanni caribou cows. This research included a winter aerial survey of caribou in the Nahanni region, between March 24-30, 2009.

Hines, Jim

Population Biologist
 Canadian Wildlife Service
 Suite 301, 5204 50th Ave.
 Yellowknife, NT X1A 1E2

Permit No.: 5581

Region(s): IN

Species: Tundra Swans

Location: Inuvialuit Settlement Region

Monitoring Cumulative Environmental Impacts of Gas and Oil Development in the Mackenzie Delta Using Tundra Swans as an Indicator Species

This study assessed and monitored the reproductive success and population size of tundra swans at a number of control and development sites. The study determined the probable effects of climate change and other stressors on the productivity and population size. It also delineated the distribution of breeding Canada and Cackling geese throughout the Northwest Territories.

Hines, Jim

Population Biologist
 Canadian Wildlife Service
 Suite 301, 5204 50th Ave.
 Yellowknife, NT X1A 1E2

Permit No.: 5661

Region(s): NS

Species: Waterfowl

Location: Yellowknife Highway

Abundance and Productivity of Waterfowl and Other Aquatic Birds Breeding in the Boreal Forest

Objectives of this study included: 1) the determination of factors that limit the size, composition and productivity of the breeding populations of aquatic birds near Yellowknife; 2) the determination of fall-winter distribution, survival and other important parameters of Horned and Red-necked Grebes near Yellowknife; 3) the determination of factors including recruitment and survival rates of Lesser Scaup near Yellowknife; and 4) the delineation of the distribution of breeding Canada and Cackling Geese throughout the Northwest Territories. Data was collected through roadside counts, surveys of transects, banding of adults and collection of eggs.

Hines, Jim

Population Biologist
 Canadian Wildlife Service
 Suite 301, 5204 50th Ave.
 Yellowknife, NT X1A 1E2

Permit No.: 5580

Region(s): IN

Species: Geese, Swans Ducks, Loons, Raptors

Location: Inuvialuit Settlement Region

Population Mangement of Geese and Swans in the Inuvialuit Settlement Region Using Aerial Surveys and Banding Studies

Study objectives included: 1) evaluating the effects of harvest and others stressors on Western Arctic populations of waterfowl; 2) delineating the distribution of breeding Canada and Cackling Geese throughout the Northwest Territories; and 3) monitoring waterfowl populations in the Inuvialuit Settlement Region. This study also monitored the productivity of snow goose colonies in the Kendall Island Bird Sanctuary and Anderson River Bird Sanctuary, as well as the migration routes, harvest rates and survival rates of the Inuvialuit Settlement Region's mainland geese populations.

Johnson, Deborah

Regional Biologist
 ENR South Slave
 PO Box 900
 Fort Smith, NT X0E 0P0

Permit No.: 4762

Region(s): SS

Species: Barren-ground caribou

Location: South Slave

Research on the Distribution and Movement of the Ahik and Beverly Barren Ground Caribou Herds

Johnson, Deborah

Regional Biologist
ENR South Slave
PO Box 900
Fort Smith, NT X0E 0P0

Permit No.: 4761

Region(s): SS

Species: Bison

Location: NWT Bison Control Area

Survey of the Bison Control Area

Johnson, Deborah

Regional Biologist
ENR South Slave
PO Box 900
Fort Smith, NT X0E 0P0

Permit No.: 4760

Region(s): SS

Species: Bison

Location: Mackenzie Bison Sanctuary

Monitoring Population and Disease Parameters on Bison in the Mackenzie Bison Sanctuary

Johnson, Deborah

Regional Biologist
ENR South Slave
PO Box 900
Fort Smith, NT X0E 0P0

Permit No.: 4759

Region(s): SS

Species: Boreal caribou

Location: Hay River Lowlands and Cameron Hills area

Research on Boreal Caribou in the Hay River Lowlands and Cameron Hills area

Johnston, Vicky

Biologist
Canadian Wildlife Service
Suite 301, 5204 50th Ave.
Yellowknife, NT X1A 1E2

Permit No.: 5582

Region(s): IN

Species: Shorebird

Location: Inuvialuit Settlement Region

Arctic Shorebird Monitoring Program

This program was part of a larger program called the Program for Regional and International Shorebird Monitoring. The objectives of this program were to: 1) generate population estimates for all arctic breeding shorebirds; 2) identify highest-quality habitats for each shorebird species; 3) produce maps showing shorebird distribution and abundance across the North American arctic; and 4) provide shorebird densities and breeding ecology information at each survey site

Kraft, Paul

Superintendent
ENR Deh Cho
PO Box 240
Fort Simpson, NT X0E 0N0

Permit No.: 5636

Region(s): DC

Species: Wood bison

Location: Fort Liard area

Nahanni Wood Bison Population Monitoring Project

The objective of this study was to monitor the Nahanni bison herd for the presence of brucellosis and tuberculosis in addition to other diseases/parasites common to bison. Monitoring of the Nahanni bison population for these two

diseases provided a measure of the effectiveness of the bison control program, as well as confirming the disease-free status of the herd.

Lambert Koizumi, Catherine

Gwich'in Renewable Resource Board
PO Box 2240
Inuvik, NT X0E 0T0

Permit No.: 5590

Species: Dall sheep, grizzly bears, wolves

Region(s): GW

Location: Richardson Mountains, west of Aklavik and Fort McPherson

Dall Sheep, Grizzly Bear and Wolf Interactions in the Richardson Mountains

This project examined the spatial and dynamics relationships between Dall sheep, grizzly bears and wolves in the Richardson Mountains. Objectives included: 1) document home ranges, movements and habitat use of the three species; 2) quantify the interactions between them, focusing on spatial dynamics, predation, nutritional ecology of grizzly bears and wolves, and behaviour (predator avoidance strategies) of Dall sheep; 3) understand how landscape features, time of the year, climate, human harvest and other disturbances may affect the interactions between the three species; and 4) document local and traditional knowledge about these three populations.

Larter, Nic

Regional Biologist
ENR Deh Cho
PO Box 240
Fort Simpson, NT X0E 0N0

Permit No.: 4970

Species: Wood bison

Region(s): DC

Location: Liard River Valley

Liard Valley Wood Bison Population Studies 2008

The objectives of this study were to measure calf, yearling and bull cow ratios during the post-calving period, as well as calculate density and distribution of bison along the Liard River Valley. The wildlife permit also authorized the deployment of ten collars on bison in order to document migration patterns along the river valley seasonally and annually. There was ongoing monitoring of population demography, non-invasive sample collection and collection of biological samples from mortalities.

Larter, Nic

Regional Biologist
ENR Deh Cho
PO Box 240
Fort Simpson, NT X0E 0N0

Permit No.: 4971

Species: Moose

Region(s): DC

Location: Mackenzie and Liard Valley of the Dehcho Region

Monitoring Moose Density and Distribution Along the Mackenzie and Liard Valley

The objective of this project was to monitor the density and distribution of moose in areas north of the Mackenzie River, including the pipeline right-of-way and areas in the Liard Valley deemed to be important by local First Nations. An additional objective was to collect biological samples from moose harvested by local First Nations in the Deh Cho region to address local concerns about contaminant levels and health of primary country food source.

Larter, Nic

Regional Biologist
ENR Deh Cho
PO Box 240
Fort Simpson, NT X0E 0N0

Permit No.: 4967

Species: Boreal woodland caribou

Region(s): DC

Location: Deh Cho region

Collaring Boreal Caribou in the Deh Cho Region

The objective of this project was to capture and deploy eight collars on boreal woodland caribou.

Latour, Paul

Habitat Biologist
 Canadian Wildlife Service, Environment Canada
 5204 50th Ave.
 Yellowknife, NT X1A 1E2

Permit No.: 4969

Region(s): DC

Species: General fauna

Location: Proposed Sambaa K'e Protected Area

Research in the Proposed Sambaa K'e Protected Area

Research was conducted in the proposed Sambaa K'e Protected Area. The research was composed of verifying and describing the main habitat components of the area, including an inventory of flora and fauna, listing key species and generating baseline data in order.

MacDonald, Robert

US Fish & Wildlife
 3000 Vintage Blvd, Suite 201
 Juneau, Alaska 99801

Permit No.: 5587

Region(s): IN

Species: Waterfowl

Location: Western Banks Island and Western Victoria Island; Sachs Harbour and Uluhaktok region

Aerial Waterfowl Survey on Western Banks and Victoria Islands, 2008

The Canadian Arctic is an important breeding area for several species of waterfowl. Data on spatial distribution and abundance from breeding areas greatly complements information gathered elsewhere and allows for more effective monitoring and better-informed management decisions. The study objectives were: 1) to obtain population-size estimates and distribution information for waterfowl and other bird species within the defined study areas to assist in a long-term population trend monitoring program, and 2) to gather essential data to assist wildlife managers in planning efforts for a long-term monitoring plan for birds in the Canadian Arctic.

Machtans, Craig

Forest Bird Biologist
 Canadian Wildlife Service
 Suite 301, 5204 50th Ave.
 Yellowknife, NT X1A 1E2

Permit No.: 4968

Region(s): DC

Species: Forest Songbirds

Location: Fort Liard area

Monitoring Long-term Population Trends of Forest Songbirds in the Fort Liard Area

Continued long-term monitoring of plots to determine if natural changes in forested habitat affect the long-term population trends of forest songbirds in the Fort Liard area.

Marshall, Rob

R Marshall and Associates
 4808 School Draw Ave.
 Yellowknife, NT X1A 2T7

Permit No.: 5667

Region(s): NS

Species: Breeding birds, waterfowl, amphibians ungulates, large carnivores, semi-aquatic mammals

Location: Whati

Nailli Hydroelectric Project

This project proposed the construction of a new 1.2 MW power plant to service the community of Whati. This is a community-based initiative with the purpose of providing Whati with clean energy to replace the use of a diesel-electric plant and enable the conversion of non-residential oil-fired space heating to electric heating. The footprint associated with the development has the potential to affect wildlife and wildlife habitat. Therefore, additional baseline information related to the type, quantity and quality of wildlife and wildlife habitat within and immediately adjacent to the study area was required. This project collected this baseline information. Data collected during the field program was used to assess the potential level of impact of the project on wildlife and wildlife habitat.

Miller, Glenn

MGM Energy Corp
Suite 4100, 350 7th Ave. SW
Calgary, AB T2P 3N9

Permit No.: 5588

Species: Muskrat, Wolverine, Grizzly bear and Moose Migratory Birds and Waterfowl Species

Region(s): IN, GW

Location: MGM Energy Corp. Project Area

MGM Energy Corp. Summer Field Assessment and Advance Barging and Staging Project: 2008-2011

This project assessed wildlife resources located within the designated areas being considered for 2008/2009 winter drilling and seismic, barge landing sites and overland access routes. Specific waterfowl species studied were the tundra swan, brant, snow and white-fronted goose, common snipe and least sandpiper. The wildlife investigation component of the project focused on identifying and documenting habitat for avian and terrestrial wildlife in the vicinity of proposed winter activities. Information collected was used in planning and determining appropriate locations for 2008/2009 drilling and seismic activity components. Recommended set-back distances were applied where areas of sensitive habitat were identified at selected sites.

Musiani, Dr. Marco

University of Calgary
2500 University Dr. NW
Calgary, AB T2N 1N4

Permit No.: 5607

Species: Wolf

Region(s): NS, SA, IN

Location: Boreal forest, central tundra and arctic regions of the Northwest Territories and Nunavut.

DNA Variation in the Northern Wolf: Adaptation Over Space and Time

The objectives of this project were to conduct hide, blood and carcass samples from wolves to determine genetic differences among the six wolf populations, to identify the genetic basis of how wolves differ from each other ecologically and to reveal specific genetic regions in wolves that lead to their adaptability and uniqueness in different habitats and ecosystems.

Nol, Erica

Trent University
1600 West Bank Drive
Peterborough, ON K9J 7B8

Permit No.: 5585

Species: Semipalmated plover

Region(s): IN, GW

Location: Gwich'in Settlement Area and Inuvialuit Settlement Region

Investigating the Strength of Migratory Connectivity in Semipalmated Plovers (*Charadrius semipalmatus*) through the Use of Stable Isotopes

This study used stable isotopes to describe the pattern of migratory connectivity in Semipalmated Plovers, and by doing so, validated the use of stable isotopes for use in shorebird connectivity studies. This study also determined the over-wintering distribution of Semipalmated plovers. Arctic-nesting species such as the Semipalmated Plovers are projected to lose much of their breeding range during this century, and so understanding the patterns of avian migration is fundamentally important for their effective conservation.

Richardson, Evan

Canadian Wildlife Service
5320 122nd Street
Edmonton, AB T6H 3S5

Permit No.: 5371

Species: Polar bear

Region(s): IN

Location: Mackenzie Delta and Near the Shore of the Beaufort Sea

Assessment of the Potential Impacts of Oil and Gas Development On Polar Bears in the Mackenzie Delta and Near the Shore of the Beaufort Sea

The study objectives of this project were: 1) to delineate potential maternity denning habitat and assess the potential for den disturbance; 2) to assess the risk and potential impacts of offshore activities to the Southern Beaufort Sea

polar bear population, and 3) to assess the impact of nearshore activities on Inuvialuit polar bear hunting along the nearshore areas of the southern Beaufort Sea coast from Mackenzie Bay to the Tuktoyaktuk Peninsula.

Slattery, Stuart

Boreal Waterfowl Ecologist
Ducks Unlimited Canada
PO Box 1160
Stonewall, MB R0C 2Z0

Permit No.: 5374

Species: Duck species

Region(s): GW

Location: Cardinal Lake area

Demographic Rates and Factors Limiting Breeding Duck Populations in the Mackenzie Valley, With Special Emphasis on Scoters and Scaup

The main purpose of this study was to obtain information on the breeding ecology and habitat requirements of waterfowl nesting in the Mackenzie Valley; in particular during the 2008 season, the objective was to identify individually marked hens that return to the study area for breeding. Information gathered was also used: 1) to begin developing a population model to better understand change in waterfowl populations in the forest; 2) to help identify factors limiting these populations; and 3) help managers make informed decisions about future land use in the Gwich'in Settlement Area.

Virgi, John

Fortune Minerals Limited
c/o Golder Associates
9 4905 48th Street
Yellowknife, NT X1A 3S3

Permit No.: 6876

Species: Ungulates, carnivorous raptors, water birds, upland birds

Region(s): NS

Location: Lou Lake; west of Snare Hydro Plant, northeast of Whati

Baseline Wildlife Studies for the Fortune Minerals NICO Project

Wildlife surveys were conducted to augment existing information on wildlife species and habitat surrounding the project base camp and along the proposed routes of an all-weather access road and a transmission line. The studies described wildlife presence, distribution, habitat associations and relative abundance to serve as a baseline for future permit applications and mitigation measures. Specific species studied included: caribou; moose; wolf; wolverine; marten; raptors; waterbirds; songbirds and other upland birds.

Wortham, James S.

US Fish and Wildlife Service
11510 American Holly Dr.
Laurel, MD 20708

Permit No.: 5605

Species: Breeding ducks and other waterfowl

Region(s): NS

Location: Behchokq

The purpose of this study was to conduct surveys to determine the size and species composition of the breeding ducks and other waterfowl in the Mackenzie River Drainage.

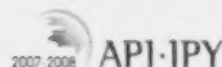


Photo Credit: Valerie Tomlinson, ARI

Andrews, Tom
Prince of Wales Northern Heritage Centre
Box 1320
Yellowknife, NT X1A 2L9
tom_andrews@gov.nt.ca

Permit No.: 2008-010
Region(s): NS, SA

Class: 2
Location: Western Mackenzie Mountains, close to the Yukon-NWT border



Archaeology Permits

NWT Ice Patch Project (2008)

Despite bad weather, which grounded the helicopter for 4 out of 8 working days, researchers were able to locate a new ice patch archaeological site—KfTd-2—where we recovered a birch foreshaft which dated to 570 ± 40 years BP. As well, at KfTe-1, recorded first in 2005, researchers recovered the distal end of spruce arrow shaft, which dated to 850 ± 40 years BP, and a ground squirrel snare, dating to 970 ± 40 years BP. The latter, which has a double twisted strand of sinew tied onto a willow branch, is an especially important artifact as it demonstrates that hunters trapped ground squirrels at the ice patches while they were waiting for caribou, providing important evidence about the range of activities at these places. Researchers also returned to site KhTf-1, recorded in 1989 by Chris Hanks, to attempt recovery of a snowshoe which he noted at the site. They were able to relocate the site and recovered three fragments of a spruce snowshoe. Researchers had postulated that the site might have been a melted-out ice patch site and the snowshoe related to its exploitation. However, it was clear that the site was not an ice patch and a radiocarbon date indicated that the snowshoe was modern in age, possibly left behind by a trapper sometime within the last 75 years.

In addition to the archaeological research, Dr. Brian Moorman and Tom Meulendyk, from the Earth Sciences Program at the University of Calgary, were able to continue their geophysical exploration of several ice patch sites. Using ground penetrating radar, and by taking ice cores, they hope to answer questions about the formation and longevity of the ice patches. This year we were also joined by Dr. Jan Adamczewski, Ungulate Biologist with the Government of the NWT. Dr. Adamczewski used dung collected at several sites, to study caribou food habits over several millennia to explore changes in diet.

Finally, researchers were also able to host the second Ice Patch Science Camp, which was attended by 4 students from Tulita, as well as by several elders. The program included learning about field recording methods such as GPS, setting ground squirrel snares, learning local place names and stories and experiencing, firsthand, the archaeology of ice patches. Students and elders were able to visit one of the ice patch sites to help with locating artifacts and drilling an ice core.

Hayden, Shannon

North Slave Métis Alliance / The University of Leicester
 PO Box 2301
 Yellowknife, NT X1A 2P7
 shayden@nsma.net

Permit No.: 2008-008

Region(s): NS

Class: 2

Location: Old Fort Rae, Eastern side of the North Arm of Great Slave Lake

Land Use and Heritage Management Plan for the HBC Trading Post Known Locally as Old Fort Rae

Old Fort Rae, located on what was known in the early historical records as Mountain Island or Rae Point, is situated on the east side of the North Arm of Great Slave Lake about 25 km south of the current community of Behchokō (Rae-Edzo) and 75 km northwest of Yellowknife. The geology and terrain of the local area around Old Fort Rae, and in general, the North Arm of Great Slave Lake includes a landscape of hilly outcrops and lowlands of silty clays. Old Fort Rae contains mainly a mixture of rich (but shallow) top soils and limestone cobble. Much of the site is largely open, arable land with parcels of natural woodland. The immediate location slopes upward from south to north in a series of four ridges, reaching approximately 185m above sea level. Vegetation includes a collage of grasses, mosses, lichens, low bushes, small willows and birch trees. Spruce, jackpine, white poplar, alder and tamarack are also present in the more wooded areas. Rose bushes, Rhubarb, green onion and possibly potato are also present in the study area indicating the presence of historic gardens, and the use of social space, associated with the Hudson's Bay Company post and Roman Catholic mission.

The North Arm of Great Slave Lake has been used since time immemorial by the Tłıchǫ, Yellowknives and Chipewyan who come from the Athabasca, Great Slave and Mackenzie Valley regions. The Métis, too, have arguably inhabited the area since the early 1700s (Hanks, 1999: 381). By the late 1700s, the North West Company (NWC) and Hudson Bay Company (HBC) had moved into the north and it is during this era that the archaeological record begins to show evidence of a mixing of traditional activities - First Nation artifacts (birchbark snowshoes, scrapers, flakes) found in association with European trade goods (broaches, beads, factory-made leather boots, etc.). The trails, place names, portages and waterways in the area attest to the continuous use of this land, by many cultural groups, and its importance as a whole, integrated landscape once used for trade, travel, exploration and communication purposes.

A wide range of potential occupational periods has been represented in both the oral histories and in the archaeological record of the site. Old Fort Rae and the surrounding area is part of a sacred landscape, important to the local peoples and their traditions. Tłıchǫ and Métis elders who participated in the survey and site visit helped identify, through their own experience, trails, portages, travel routes, auxiliary sites and place names that are important features of traditional life in the region.

Understanding the cultural landscape and its values are absolutely necessary for deciding how the land will be managed (GNWT, 2007: 18). The intangible cultural values, activities, practices, relationships and beliefs associated with the landscape must be respected and protected in the same way as the archaeological and physical materials discovered during site surveys (GNWT, 2007: 22). The aim of conducting archaeological studies at Old Fort Rae is to map and document culturally significant site and landscape features and to interpret the inter-relationships between cultural deposits, oral histories, the environment and the landscape so that areas of cultural and spiritual significance can be avoided and respected by current and future land users (GNWT, 2007: 14). The ultimate goal of this survey and the associated research is to work closely with the Métis and Tłıchǫ to develop a Territorial Historic site nomination and Heritage/Land Use Management Plan for Old Fort Rae.

Post-depositional processes as a result of erosion and deposition are fairly limited due to the low precipitation rates and continuous vegetation cover. However, recent human activity in the area, as well as large game movement, such as caribou, bison and moose, has impacted the distribution of artifacts on the surface. Some of the management issues that will need to be addressed in developing a Heritage/Land Use Management Plan include clearing the remains of some cellars that have been backfilled with brush and garbage, deciding how to deal with the fact that the modern cabins are built immediately over the foundation of a historic building or dwelling and how to reduce the impact of the ATV trails cutting through the local area, disturbing the ground, including the cemetery, moving and exposing buried objects.

Because of the relatively small size of the known Old Fort Rae site, the entire immediate area was surveyed using a combination of foot traverses, total station theodolite surveying equipment and Geographic Positioning Systems (GPS). All archaeological material encountered has been recorded on a "Site Entry Form" and mapped using GPS.

Additional field work planned for next summer will explore in more detail local people's oral histories, the extent of archaeological material represented at the site, and begin to develop plans for heritage resource management.

MacKay, Glen

Prince of Wales Northern Heritage Centre
Box 1320
Yellowknife, NT X1A 2L9
glen_mackay@gov.nt.ca

Permit No.: 2008-009

Region(s): NS

Class: 2

Location: Old Fort Reliance, East Arm Great Slave Lake

Kache Archaeology Project

The goal of the Kache Archaeology Project was to map and characterize historic features at the log house village of Kache. This work was carried out in the context of a larger project organized by the Ałt̨s̨łk'e Dene First Nation (Lutsel K'e DFN) to assess the heritage and interpretive values of Kache and document oral history related to the village.

Located at the mouth of the Lockhart River, Kache was occupied by several families from approximately 1946 until 1949. Most of the residents of Kache relocated to Ałt̨s̨łk'e after abandonment of the village. The village of the late 1940s consisted of ten log cabins with associated features such as raised caches, dog houses, sheds and other features. While researchers found remains of at least 5 additional log structures in the area, these were not part of the village described by the Ałt̨s̨łk'e elders that lived at Kache in the 1940s, and likely represent separate occupations of the site.

The assessment of the Kache village site – conducted in collaboration with the LKDFN and Parks Canada – included detailed mapping of all of the village features and local topography, recording of the architectural details of the log buildings on standardized recording forms and photo-documentation of all structures and associated features. In addition, the LKDFN conducted detailed interviews with elders that lived at this village in the 1940s.

MacKay, Glen

Prince of Wales Northern Heritage Centre
Box 1320
Yellowknife, NT X1A 2L9
glen_mackay@gov.nt.ca

Permit No.: 2008-007

Region(s): DC

Class: 2

Location: Sambaa K'e (Trout Lake), NWT

Sambaa K'e Archaeology Project

Glen MacKay of the Prince of Wales Northern Heritage Centre continued an archaeological survey of the traditional land use area of the Sambaa K'e got'ine (Trout Lake People) under NWT Archaeologists Permit 2008-007. Edward Jumbo (Sambaa K'e Elder), Margaret Jumbo (translator) and Jessica Jumbo (research assistant) were partners in this project. Several community students also participated in the fieldwork.

A collaborative effort between Elders, students and archaeologists, the Sambaa K'e Archaeology Project involves visiting important cultural places identified by the Elders of the Sambaa K'e Dene Band, and documenting them as archaeological sites. The project has a strong educational component for high school students from the community, with students receiving instruction in archaeological survey methods and learning about important cultural places from community elders.

The research team recorded nine new archaeological sites and revisited four previously recorded archaeological sites during the project. The sites recorded consist primarily of precontact lithic scatters and sites containing artifacts from the historic period. Interesting sites include a place – named Tsih Miñ – where people used to extract a red mineral for use as a pigment, and the location of an intact birch toboggan (approximately 75 years old) found on the bank of Trout River.

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Permit No.: 2008-005

Region(s): NS, SS

Class: 2

Location: A corridor from Twin Gorges Facility to Ekati Diamond Mine

Taltson Hydroelectric Expansion Project

In July and August 2008, Golder Associates Ltd. conducted an archaeological survey on behalf of the Dezé Energy Corporation for the proposed Taltson Hydroelectric Expansion Project. This project involves upgrades at the existing 18 MW Taltson Twin Gorges power plant and the installation of transmission lines from Twin Gorges to the Diavik, Snap Lake, Ekati and Gahcho Kué diamond mines.

Archaeological reconnaissances focused on a one-kilometre wide corridor along the length of the proposed transmission line route, as well as on the construction footprints of the proposed canal, control structure and associated staging areas. Reconnaissance was also conducted along the proposed winter road route and at several staging areas. The survey aimed to identify areas where the proposed project and its activities could potentially impact heritage resources. Special attention was given to known areas of high site density, and areas of anticipated high archaeological potential, such as river crossings, portages, shorelines and elevated topography. Along the transmission line route, survey focused at the points of intersection, where the lines would change direction and larger towers would be required.

Survey was accomplished by low level helicopter reconnaissance in conjunction with pedestrian survey with shovel testing in areas with limited surface visibility. Shovel testing was necessary in areas below the treeline where vegetation hindered visibility. Above the treeline, subsurface testing was not necessary to locate sites, with good exposure and a lack of vegetation making archaeological materials clearly visible on the surface. Johnny Desjarlais, aboriginal assistant from Fort Smith, assisted the field survey from Twin Gorges to the Lockhart River

A total of nine previously unrecorded archaeological sites were identified during the survey (KaNq-10, KhNo-1, KhNp-1, KhNp-2, KjNp-9, KjNt-12, KiNr-3, LaNr-4 and LdNr-2). Of the nine sites, KaNq-10 was found below the treeline on the shore of Sparrow Bay (Nonacho Lake). KaNq-10 is a small quartz scatter found on exposed bedrock on the shoreline. The remaining eight were located above the treeline on exposed eskers or sandy ridges. These sites were predominantly lithic debitage scatters. However, KjNt-12, located between the Gahcho Kué and Snap Lake diamond projects, contained 6 tent rings and KiNr-3, located approximately 3.5 km south of Zyena Lake on a high point of a rocky esker, contains the remains of a cairn constructed with four large cobbles. LaNr-4, also identified on an esker 2.5 km west of Outram Lake, contained the remains of several axe-cut pieces of spruce trees. The wood was very weathered with heavy lichen growth present.

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Permit No.: 2008-004

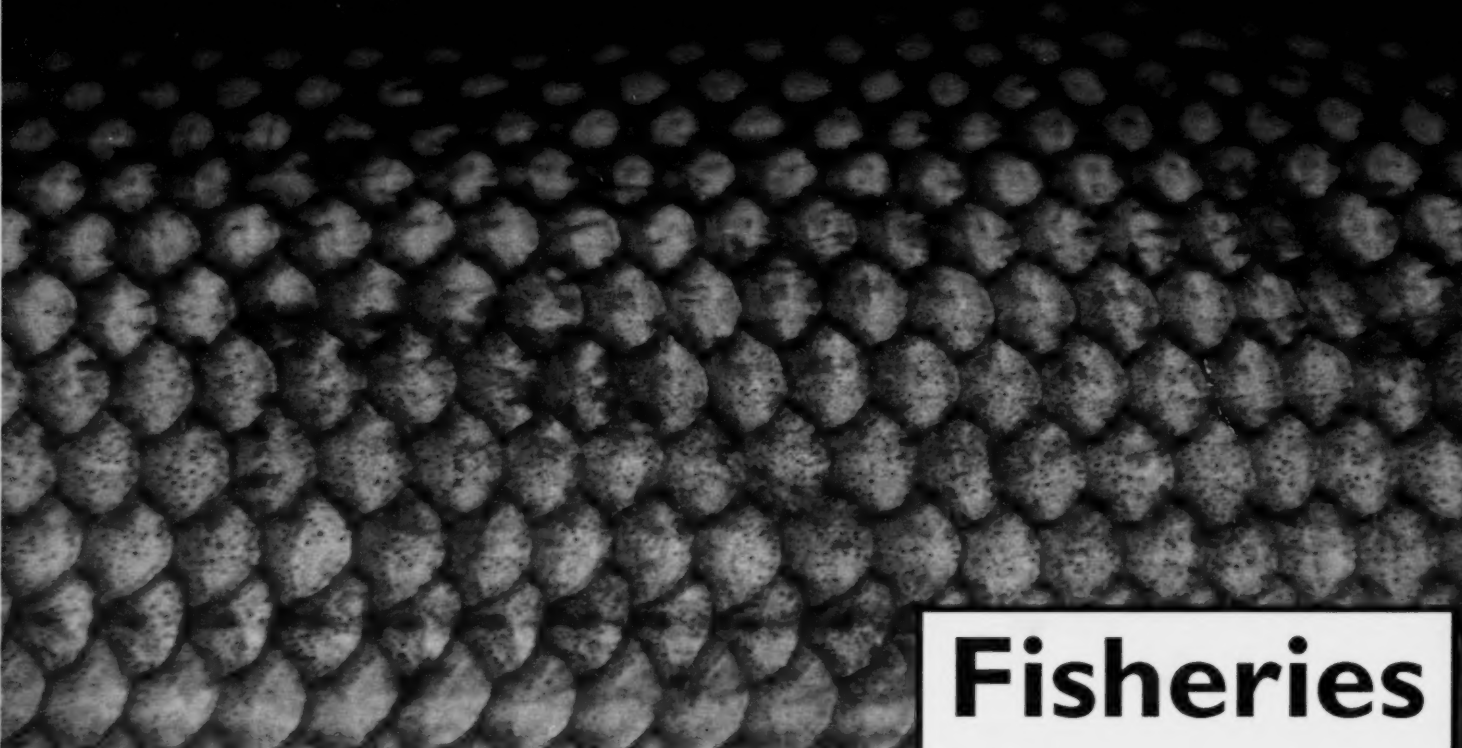
Region(s): IN

Class: 2

Location: Mackenzie Delta

MGM Energy Corp. Summer Field Assessment and Advance Barging and Staging Project: 2008-2011

This fieldwork was confined to Ellice Island, Langley Island and the Arvoknar Channel shoreline. The researcher surveyed 13 well pad locations, 5 access routes, 2 barge landing locations (one with associated camp and airstrip area) and an onshore storage area. The environment of these locations ranged from wetland to storm surge killed willow flats. This area is very dynamic with seasonal flooding, and modification of bank areas. The shovel testing program proved this up as the majority of soil profiles consisted of wet silt, some even filling with water as they were being dug. The areas of proposed winter development are of low archaeological potential and there was no discovery of any previously unrecorded sites or to revisit any sites currently in the data base. No surveying was completed in the Umiak area on the east side of the delta (an area of higher archaeological potential) like originally planned.



Fisheries Permits

Photo Credit: Paulo Fleg, ARI

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Permit No: S-07/08-2057-HR-A1 **Fish Species Studied:** All species
Region: NS

DeBeers Snap Lake Mine: 2008 Fisheries Effects Monitoring Program
See **Azzolini, Louie**, NWT research Licence No. 14381 on page 1 for research summary.

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Permit No: S-08/09-4031-IN **Fish Species Studied:** All species
Region: IN

Northern Marine Coastal Studies Program

The central objective of this project is to provide data regarding the presence of fish in support of an on-going multibeam mapping program of the Beaufort Sea floor, and to contribute to the general biological and ecological information on offshore pelagic and benthic fish populations. Secondary objectives included: 1) ground-truthing data from the hydro-acoustic surveys of the biota on the sea floor and in the water column; 2) providing samples for an ongoing study of the trophic structure of Beaufort fish populations; and 3) providing samples for ongoing genetic (stock structure and variability) and contaminant studies of fishes in this area.

Fish were collected as part of the Northern Coastal Marine Studies program, which is a multidisciplinary study aimed at characterizing the physical and biological nature of the Beaufort Shelf through a multi-year habitat mapping program. In the context of this study, habitat mapping is the process of identifying, characterizing and mapping the physical, ecological and human variables that influence the abundance and distribution of species in an area. Fish were collected using standard fisheries research techniques including multi-mesh gill nets, a 3 metre Enzenhofer and Hume mid-water trawl, and a 3 metre beam trawl. Invertebrate by catch were sub-sampled for reference collections and for isotope analysis.

In light of recent intensive hydrocarbon exploration in the Canadian Beaufort Sea, samples from these fish will contribute valuable information regarding the general biology, trophic structure and contaminant loads of biota in the relatively poorly understood Beaufort Sea ecosystem.

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Permit No: S-08/09-4034-IN **Fish Species Studied:** All species
Region: NS

Nailii Hydroelectric Project

See **Cote, Jason**, NWT Scientific Research Licence No. 14429 on page 2 for research summary.

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Permit No: S-08/09-4036-IN **Fish Species Studied:** All species
Region: SS

Dezé Energy Corporation Ltd. Taltson Expansion Project - 2008 Fisheries Field Program

See **Azzolini, Louie**, NWT research Licence No. 14381 on page 1 for research summary.

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Permit No: S-08/09-4007-IN **Fish Species Studied:** Burbot
Region: NS

Ecology of a Boreal Fish, the Burbot: Implications for Northern Development

The objectives of this project were to: 1) define the role burbot play in boreal lake ecosystems through an assessment of trophic position and food web dynamics of burbot relative to sympatric boreal fish species and make comparisons, among lakes, among apex predators and between climatic regions; 2) examine the reproductive ecology of burbot, determine the drivers of reproductive effort, among lakes and compare between climatic regions.

The conducted survey using NORDIC nets provided information on fish size, biomass, community structure (i.e., composition) and relative abundance of resident fishes. Due to the difficulty of capturing burbot in gillnets, burbot were sampled using baited long lines in a randomized and standardized way to get catch-per-unit-effort for relative abundance estimates. These estimates are used to compare burbot populations among lakes and the ratio of burbot to other fishes among other lakes. Alternative gear (angling and large mesh gill nets) were used to collect northern pike and lake trout of bigger size classes that were not as susceptible to being caught in NORDIC nets.

Burbot were targeted in the winter and collected using longlines set under the ice with the aid of jigger boards. The fish were sampled between late January and early March to collect fish before, during and after spawning. 30 burbot were collected from each waterbody at each sampling effort. All burbot were processed in the lab and the following information was collected: total length; body weight; sex; sexual maturity; gonad weight; liver weight; stomach contents; presence of swim bladder musculature; and gutted body weight.

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Permit No: S-08/09-4013-IN

Fish Species Studied: Arctic grayling

Region: DC

Selwyn Project Fisheries Baseline Study

See **Essar, Natasha**, NWT Scientific Research Licence No. 14349 on page 3 for research summary.

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Permit No: S-08/09-4002-IN

Fish Species Studied: Lake trout and burbot

Region: DC

Spatial and Long-term Trends in Persistent Organic Contaminants and Metals in Lake Trout and Burbot from the Northwest Territories

See **Evans, Marlene**, NWT Scientific Research Licence No. 14365 on page 15 for research summary.

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Permit No: S-08/09-4010-IN

Fish Species Studied: Lake trout

Region: IN

Biological Studies of Waters Along the Proposed Mackenzie Gas Project Pipeline Route – Inuvialuit Settlement Region (Husky Lakes Subproject)

No research was conducted under this Fisheries Permit.

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Permit No: S-08/09-4012-IN

Species Studied: Invertebrates

Region: IN

Biological Studies of Waters Along the Proposed Mackenzie Gas Project Pipeline Route – Gwich'in Settlement Region

No research was conducted under this Fisheries Permit.

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Permit No: S-08/09-4014-IN

Species Studied: Invertebrates

Region: SA

Biological Studies of Waters Along the Proposed Mackenzie Gas Project Pipeline Route – Sahtu Settlement Region

No research was conducted under this Fisheries Permit.

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Permit No: S-08/09-4015-IN
Region: IN

Species Studied: Invertebrates

Biological Studies of Waters Along the Proposed Mackenzie Gas Project Pipeline Route – Inuvialuit Settlement Region

No research was conducted under this Fisheries Permit.

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Permit No: S-08/09-4022-IN
Region: SA

Fish Species Studied: Lake trout

Surveillance and Monitoring of Brominated (Flame Retardants) and Fluorinated Contaminants and Degradation Products in Great Bear Lake Lake Trout

The objective of this project is to obtain new information on brominated (flame retardants) and fluorinated contaminants in large lakes across Canada, as well as other chemicals like mercury, to determine if chemical levels are changing in the water.

This project is part of a larger Environment Canada national program that is being developed to monitor brominated (flame retardants) and fluorinated contaminants in large lakes across Canada. It builds on ongoing programs in the Laurentian Great Lakes and complements the Northern Contaminants Program. Great Bear Lake was selected for inclusion in the program because of the unique nature of this large lake, and the fact the Déline has indicated a strong need for monitoring of this lake. Mercury and other chemicals were also measured in the fish.

Twenty lake trout were collected from Great Bear Lake by community members from Déline during their normal subsistence fishing activities. All fish were captured using gill nets or by angling. Whole fish were frozen and then shipped to Environment Canada-Saskatoon, where they were processed. Tissue samples were submitted to Environment Canada laboratories in Saskatoon and Burlington for stable isotope and contaminant analyses.

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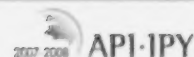
Permit No: S-08/09-4028-IN
Region: SS

Species Studied: Invertebrates

Biological Studies of Waters Along the Proposed Mackenzie Gas Project Pipeline Route – Deh Cho and South Slave Settlement Regions

See **Evans, Marlene**, NWT Scientific Research Licence No. 14387 on page 4 for research summary.

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Permit No: S-08/09-4030-IN **Fish Species Studied:** Arctic charr
Region: IN

Baseline Fish Study and Char Community-Based Monitoring Plan for Sachs Harbour

The objectives of this study were to conduct baseline studies for freshwater fish and anadromous fish in the areas surrounding Sachs Harbour and to provide local the Hunters and Trappers Committee and Department of Fisheries and Oceans fisheries managers with a picture of what is occurring in the region.

Arctic char is a circumpolar species that is distributed across a wide latitudinal and climatic range, from the High Arctic to temperate locations. There is scientific evidence indicating significant warming in much of the Arctic, representing a direct threat to the biological viability of many populations, and is associated with a net increase in temperature mediated contaminant accumulations in fish tissue. Although biological responses to climate change can be predicted, predictions cannot be validated on the basis of present evidence.

The community of Sachs Harbour was noticing changes in the numbers and sizes of their char in the areas surrounding Sachs Harbour. The Fisheries Joint Management Committee, the Department of Fisheries and Oceans in Inuvik and the Community of Sachs Harbour requested this baseline fish study for the area and the creation of a community-based monitoring for char.

Arctic char was sampled from seven locations around the Sachs Harbour area for analysis of the otolith, tissue samples and stomach contents. This data provided information towards: 1) Length, weight and age frequencies of the char; 2) responses of char to variability in context of climate change; 3) established baseline conditions, current char biodiversity and provide a point of reference against which future changes can be compared; 4) provided data and knowledge towards the creation and implementation of community-based monitoring plan; 5) future assessments of genetic and morphological variation, genetic population structure and variation in the dynamics of char populations within the Sachs Harbour area; and 6) the development of a long-term community-based monitoring plan for char populations in the area.

For all fish species, multi-mesh gillnets (4-8 net setting sites) for 3 hour sets over 12 hour periods for 4 days each locale. The multi-mesh gill nets were made up of 20 m panels (seamed together) of each of the following bar mesh sizes: 10 mm (110/2 twine), 19 mm (110/3), 33 mm (110/3), 45 mm (210/2), 55 mm (210/3) and 60 mm (210/3)); net depth = 1.8 m. All fish captured were weighed, measured (fork and total length), photographed and sexed if possible. All Arctic char species released alive. 75 char from each site will be dead sampled (for otoliths, tissue and stomach contents). All fish data collected in the field was submitted to the Inuvik office for use by the Department of Fisheries and Oceans.

Ekman Dredge, Wisconsin plankton net and D-net were also used to collect benthic invertebrates and plankton. 3 dredge hauls per lake location and 3 locations from the river mainstem (pool, riffle, run habitats) were taken. Samples were preserved and transported to the lab for future follow-on analysis sorting, enumeration, identification and isotope analysis.

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Permit No: S-08/09-4035-IN **Fish Species Studied:** Arctic grayling
Region: DC

Canadian Zinc – Prairie Creek Winter Access Road – Fisheries Update and Harrison Creek Habitat Compensation Studies

See **Thomas, Craig**, NWT Scientific Research Licence No. 14382 on page 11 for research summary.

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Permit No: S-08/09-4000-IN
Region: IN

Species Studied: Bowhead whale

Bowhead Whale Tagging - Beaufort Sea 2008

The objectives of this study were 1) to conduct a replicated aerial study to provide real-time regional information on the distribution of bowhead whales at the time of the seismic survey and tagging, and this in turn will be available for mitigation purposes; 2) the satellite tagging of bowhead whales will provide a view as to how the whales use the feeding aggregation areas, residence times and possible reactions to seismic operations; 3) by collaborating with colleagues in the Department of Fisheries aboard the MV Nahidik, an attempt will be made to sample amongst feeding whales and thereby better understand why certain areas are attractive to the whales (e.g. prey quality and quantity).

Bowhead whales of the Western Arctic population come to the Beaufort Sea each summer to feed, and form large loose aggregations in the offshore Beaufort from approximately mid August to late September. The aggregations form in traditional areas where oceanographic conditions favour the concentration of zooplankton, their main prey item. Not all aggregation areas are attractive to bowheads in all years, due to varying oceanographic conditions. Some of these feeding aggregation areas are located in offshore waters which have been subject to seismic exploration activity in the 1980's, in 2006 and 2007 and for which extensive seismic projects are planned for 2008. In addition, on their return fall migration to the Bering Sea, this same stock is also subject to extensive shipping and seismic activities in the Alaskan Beaufort and Chukchi seas.

Satellite recording tags were applied to bowhead whales at Atkinson Point during August 2008, to provide information on individual whale movements and insight into the patterns of use of the feeding aggregation areas (residence time, diving behaviour, movements amongst areas). All tags were attached to the whales by means of an anchor implanted in the blubber layer. The anchor, composed of stainless steel, consists of a central rod with two to three flexible flat barbs alternately fixed along the shaft of the rod. The barbs are designed splay out with any outward pull of the tag so as to hold the tag in the blubber layer. Maximum penetration was restricted to 28 cm.

Two types of tags were used. The first one is an implantable "SPOT" tag. The tag is housed in a stainless steel cylinder (17 cm long x 20 mm diameter) with the anchor mounted at the bottom of the cylinder and a wire antenna (15 cm) extending from the top. The anchor and tag are implanted in the blubber layer with a small portion (4-8 cm) of the tag and the entire antenna sticking out. The second tag type is a "SPLASH" tag. This tag is a low-profile flush-mounted tag, oval in shape, 25.2 mm thick x 53.8 mm wide x 78.2 mm long. The tag is embedded in epoxy and mounted on a stainless steel base. The anchor is mounted to the bottom of the steel plate.

Prior to tagging, the anchor was sterilized with an antiseptic. Tags were partially implanted into the skin and blubber (<20 cm in depth) using an airgun or pole or harpoon. The tags will operate for up to 12 months; however, it is likely that tags will be ejected from the body through the normal healing process prior to that time. The information gained through this study is essential for the assessment of potential impacts of offshore development on bowhead whales in the Southeast Beaufort Sea, and for regulation of such activities.

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Permit No: S-08/09-4024-IN
Region: IN

Species Studied: Ringed seals

Assessment of Reproduction, Condition Disease and Contaminants of Ringed Seals and Bearded Seals through Harvest-Based Monitoring at Ulukhaktok, Northwest Territories, 2008

The objectives of this study were: 1) in community-based programs, to sample and measure 100 ringed seals taken in the annual harvest in the Ulukhaktok area, using reproductive status and body condition as indicators of ecosystem productivity and fluctuations in the seal population; 2) to examine the aspects in objective 1 in the context of regional

ice conditions; 3) to co-ordinate with, and provide samples for, "stock health" related studies, such as disease and contaminants; and 4) in community-based programs, to sample and measure any bearded seals that happen to be taken in the annual harvest in the Ulukhaktok areas, to examine reproductive rates, growth, condition and prey preferences.

A community seal monitor from Ulukhaktok took measurements and samples from seals taken in the subsistence harvest. The hunters brought their seals to the monitor for sampling (aging structures, tissues for contaminants testing, tissues for disease testing, reproductive tracts, stomachs, lungs) and measuring (weight, girth, length, fatness). Samples were either frozen or preserved. This is the 17th year of the project in Ulukhaktok.

Measuring body condition along with ovulation rate and percent pups provides a practical means with which to monitor the ringed seal population in an area, with the assistance of the local community hunters as monitors. The work associated with this project to date has illustrated that a noticeable link exists between body condition and ovulation rates of ringed seals, even in years where no apparent climatic perturbations might adversely affect the production or availability of seal food. The researchers have also documented that local, small scale premature disruption of the land-fast ice breeding habitat can have a significant negative impact on the growth, condition and probably survival of unweaned pups. It is important to consider these aspects when making long term assessments of seals or polar bears. Without information on the status of the seal population, it is more difficult to interpret changes in the polar bear population.

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Permit No: S-08/09-4018-IN

Fish Species Studied: Cisco

Region: SA

Cisco Diversity in Great Bear Lake, Northwest Territories

The objectives of this study were: 1) examine the morphological, meristic and life history characteristics of archived ciscos collected from Great Bear Lake over the past 6 years to test the hypothesis that there are multiple forms/species including shortjaw, 2) conduct targeted sampling and examination of characteristics for cisco from deeper regions of Great Bear Lake (>50 m) to increase sample size and increase the range of surveyed habitat, 3) compare Great Bear Lake cisco with shortjaw cisco identified in other lakes to verify species identification and provide information that will feed into broader questions regarding the taxonomy of shortjaw cisco.

Recent fisheries assessment studies in Great Bear Lake suggest there may be up to three forms of cisco. Based on preliminary observations, cisco captured in deeper waters of Great Bear Lake (>50 m) show characteristics that are consistent with those described for shortjaw cisco (*C. zenithicus*) including shorter, fewer and more widely spaced gill rakers and a lower jaw that is shorter than the upper jaw. With the exception of Great Bear, shortjaw ciscos have been reported from most of the remnant proglacial Great Lakes in North America running from the Laurentian Great Lakes northwest to Great Slave Lake. Thus preliminary findings indicate this species may have a more northerly distribution than previously shown.

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Permit No: S-08/09-4025-IN

Fish Species Studied: Lake trout

Region: SA

Great Bear Lake Stock Assessment

The objectives of this project were: 1) to gather baseline data on size and age structure, fecundity (egg number per female), growth and mortality of Dease, Smith, McVicar, McTavish and Keith arm lake trout, 2) to determine if lake trout are genetically distinct between basins; 3) to determine the extent of movements (if any) by lake trout in Great Bear Lake by using molecular genetics.

This project is a continuation of the lake-wide assessment of the stock structure, population characteristics and movements of lake trout throughout Great Bear Lake. This study involved the collection of up-to-date assessment

data from Dease, Smith, McTavish, McVicar and Keith Arms (previously assessed by the Department of Fisheries and Oceans in the early 1980's). To date one year of data has been collected from all arms.

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Permit No: S-08/09-4026-IN

Species Studied: Invertebrates

Region: IN

Establishing a Baseline for Aquatic Invasive Species Monitoring in the Canadian Arctic

The objectives of this project were to conduct a pilot study in two representative sites from the eastern and western Arctic to develop sampling methodology for surveying invasive biota in these regions and establish inventory of invertebrate species with the goal of providing a baseline for future monitoring for invasive species.

Global warming, resource exploitation and the resulting increase in shipping activity in the north are expected to increase the risk of exotic species introductions in the near future. Exotic aquatic species most commonly gain access to new waters in ship ballast water or attached to the hulls of foreign ships. These species can be introduced and eventually become established when ballast water is exchanged, or dumped and replaced with cargo. Introduced aquatic species can severely alter the ecosystem resulting in impacts at multiple levels of the food chain, from invertebrates and fish through to marine mammals and humans. This project addressed the need for a synthesis of existing information on environmental conditions, biota and shipping activities to identify potential pathways for invasion in key regions of the Arctic. The inventory of marine invertebrates created through this study will help to provide a baseline from which to monitor for the presence of foreign species that may be introduced through future shipping activity. Early detection of such species can allow for mitigation before the problem spreads and becomes unmanageable. This inventory will also be used in combination with the literature synthesis to provide a sound scientific basis for the selection of alternate ballast water exchange zones by Transport Canada.

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Permit No: S-08/09-4027-IN

Fish Species Studied: Dolly Varden

Region: GW

Population Assessment of Dolly Varden in the Rat River 2008-2009

The objectives of this project were 1) to obtain a long-term record of Dolly Varden catches at the various traditional fishing locations where the Rat River stock is caught (this serves as a check on the harvest study information, and increases the profile of management initiatives and concerns in regard to this fishery); 2) to monitor the number, size, sex, age and maturity of Rat River Dolly Varden taken at each of three harvest locations (this information provides a measure of the stock status and health); 3) to facilitate return of fish tags recovered in the Rat River subsistence fisheries; 4) to enhance and utilize existing expertise in the community in the collection of biological data, and to assist with the delivery of the biological program.

In 2008 samples were taken by community monitors (Fort McPherson and Aklavik) at the same three locations as in 2007: Big Eddy, the mouth of the Rat River and Destruction City. These monitors were the only fishers able to fish this stock and did so under an experimental license to obtain the necessary biological samples for assessment of the stock status. 40 charr per station were collected and age, sex, maturity, body condition and catch per unit effort measurements were taken.

Additionally, a one time only comparison of aging structures (fins and otoliths) was conducted to investigate the feasibility of using non-lethal aging structures such as fin clips for future aging of Dolly Varden charr. In order to facilitate the aging comparison, monitors collected pelvic and pectoral fin rays in addition to the otoliths which are routinely taken as part of the biological sampling.

Recent monitoring efforts have revealed a decrease in size and age and a reduced frequency of males in the catch. This has been accompanied by a reduction in catch per unit effort. These findings suggest that the fishery was unsustainable at previous harvest levels, and that continued monitoring is necessary to keep tabs on the situation and make necessary adjustments to the fishery through the Fishing Plan process.

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Permit No: S-08/09-4029-IN **Fish Species Studied:** Dolly varden
Region: GW

Rat River Dolly Varden Mark-Recapture Program

The objectives of this project were: 1) to obtain an estimate of population size of Dolly Varden Char in the system; and 2) to enhance and utilize existing expertise in the community in the collection of biological data, and to assist with the delivery of the biological program.

DFO has been conducting mark-recaptures studies in the Fish Hole area of the Rat River over the past 12 years (1995-present) to provide estimates of population size (numbers) of anadromous Dolly Varden in this system. These studies are typically conducted every 3 years (the most recent was in 2007).

Mark-recapture studies depend on recaptures to allow for estimation of population size. In the past, recaptures were obtained through the harvest monitoring study. Population size is estimated by comparing the ratio of marked (tagged) to unmarked fish in the harvest. In recent years however, the fishery has been closed and now a maximum of only 120 fish may be taken annually during the harvest monitoring study. The low number of captures could have resulted in much more uncertainty in the 2008 population estimate. An accurate population estimate is a critical piece of information in evaluating the status of the Rat River population and northern Dolly Varden as a whole. In order to obtain a reasonable target precision for the 2008 population estimate the researchers examined 300-600 fish. Live captured fish were measured, categorized by life history type and sex, and examined for tags or other marks (adipose clips) to determine proportion of tagged and untagged individuals, as well as the percentage tag loss (individuals tagged in fall 2007 were also adipose clipped). A fin clip was also taken for genetic work and age determination.

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Permit No: S-08/09-4032-IN **Fish Species Studied:** Arctic charr
Region: IN

Charr Monitoring at Hornaday River, Northwest Territories, 2008

The objectives of this project were: 1) maintain charr monitoring project and continue to provide information on status and life history of the charr stock; and 2) continue to provide important support information for the formulation, delivery and compliance of the Paulatuk Charr Management Plan.

This harvest-based program involves enumerating and measuring Arctic charr taken in the annual harvest at Hornaday River each August since 1990. Indicators of stock status such as catch per unit effort, age, length, weight, sex and maturity are used to evaluate the impact of the fishery on the stock, and to provide information on status and life history of the charr stock. Sampling for this project has been conducted independently by locally hired monitors from Paulatuk in past years.

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Permit No: S-08/09-4033-IN **Fish Species Studied:** All species
Region: IN

Hay River Harbour Area Baseline Stock Study

As part of the Hay River Domestic Study, the purpose of this project was to collect data on the present status of fish stocks in the Hay River harbour area for comparison with future studies. In addition to the collection of biological data; fish health and contaminants will be documented.

Except for a previous study of spawning whitefish that run into the Hay River, there has been a lack of fish stock studies within the Hay River Harbour area. The Hay River harbor area has been and continues to be used by First Nations to fish for subsistence purposes, including members of the K'atl'odeeche and West Point First nations. First Nations have had concerns about the abundance, size and quality of fish caught in the area. They also wanted documentation of the status of fish stocks in the area before harbor and barge activity increase should the Mackenzie Valley pipeline be constructed.

Gangs consisting of 45 5 meter sections of 89, 114, 127, 133 and 139 mm gillnet were set in various areas of the Hay River Harbour area to collect data on species composition and catch per unit effort. The catch was sampled for fork length, round weight, sex and maturity and aging structures. Diseased fish were sent to the Department of Fisheries and Oceans at the Freshwater Institute in Winnipeg. In addition to the biological component, flesh samples and sediment samples were collected and analyzed for contaminants.

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Permit No: S-08/09-4016-IN
Region: IN

Fish Species Studied: All species

Yukon North Slope Trapnet Study

The objectives of this study were: 1) to establish benchmark data for fish populations in nearshore North Slope waters - for future monitoring efforts by environmental impact assessors, regulatory agencies and environmental stewards; 2) to examine changes to fish community over the past 20 years to put into proper context future studies examining the impacts of climate change, gas & oil development and exploitation; 3) to develop a better overall understanding of the nearshore ecosystem to allow ecosystem based management of its resources; 4) to determine the condition of populations of specific species of special interest to communities and fisheries managers e.g., the condition of cisco populations; 5) to support, by providing samples, other research, having linkages to our project, in the area including: the offshore marine fish program - CCGS Nahidik; Sensitive Species fish project funded by Gas Pipeline money; PERD funded stable isotope study; genetics research on North Slope charr; ongoing contaminants research; and research examining the lowest trophic levels of the food web through stable isotope analysis.

Nearshore coastal waters along the Yukon North Slope serve as an important migration corridor and feeding area for both anadromous and marine fish species and are an extremely important component of the Beaufort Sea ecosystem. Certain fish species found in these waters, e.g. Dolly Varden, cisco and whitefish, are of considerable importance to the aboriginal people of the area. A field camp was established at Phillips Bay, Yukon within the borders of Ivvavik National Park. Large trapnets set along the shore were the principle sampling gear; supplemented by sampling with beach seines and off-shore gillnet sets. Trapnets were installed early in the open water season (about June 24) and operated continuously until early September. A field crew of five was required to run the field operation. The survey collected information on species occurrence, the relative abundance of various species, the structure of the population for each species captured and a clear picture of how this structure changes over the course of the open water season. Basic biological data, collected for all captured fish also included species and length. Sacrificed sub-samples provided weight, age, sex, maturity, stomach contents data as well as tissue samples for stable isotope, genetics and contaminants analyses. Basic water chemistry data was collected throughout the sampling period.

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Permit No: S-08/09-4005-IN
Region: NS

Fish Species Studied: Arctic grayling

EKATI Diamond Mine – Fish Monitoring Program 2008

Objectives of the studies included: (1) monitor the use of the stream habitat in the Panda Diversion Channel by fish, particularly Arctic grayling; (2) compare the biological characteristics of fish populations in the Panda Diversion Channel with those in nearby reference streams (Pigeon and Polar-Vulture streams); (3) sample the fish populations in the Pigeon Watershed (i.e., Pigeon Stream and Pigeon-Fay Stream) as part of the baseline inventory for the EKATI area and in anticipation of possible infrastructure development in the future; (4) monitor the use of the stream habitat in Nero-Nema Stream (specifically evaluating the effectiveness of streambed modifications) by fish, particularly Arctic grayling; and (5) monitor biological variables of lake trout and round whitefish sampled from Cell E of the EKATI Long Lake Containment Facility.

This study was split into four distinct sampling areas: Panda Diversion Channel; Pigeon Stream; Nero-Nema Stream; and Pigeon-Fay Stream. Fish entering the Panda Diversion Channel, Pigeon Stream and Pigeon-Fay Stream in the spring were sampled with box traps. Arctic grayling spawners were tagged in order to follow their movements in and out of the watercourses. Juvenile and adult fish leaving the Panda Diversion Channel, Pigeon Stream, Pigeon-Fay Stream and Polar-Vulture Stream were counted through fyke nets. Densities and size-at-date within these four streams were measured with dipnets and backpack electrofishers.

The fish populations in Pigeon Stream, Pigeon-Fay Stream and Polar-Vulture Stream were sampled at lower intensity than the Panda Diversion Channel with fyke nets, dipnets and electrofishers. Spawners were not be counted through box traps or tagged in Polar-Vulture, but were counted by walking surveys. The majority of the sampling in the four streams was conducted with the fyke nets.

In Nero-Nema Stream, Arctic grayling spawners as well as newly-emerged Arctic grayling fry were sampled to assess the fish population. Nero-Nema stream were sampled at low intensity.

In Cell E of the Long Lake Containment Facility, gillnets were used to sample for lake trout and round whitefish. A subset of adult fish captured was sacrificed and sampled for otoliths, ovaries, stomach, bile, liver and muscle tissue were collected.

Approximately ten adult grayling from the Panda Diversion Channel were sacrificed for fecundity information and fifty-five young-of-the-year grayling from each of the Panda Diversion Channel, Pigeon, Pigeon-Fay, Polar-Vulture and Nero-Nema streams were sacrificed for aging. A total of ten adult lake trout and ten adult round whitefish from Cell E of the Long Lake Containment Facility were sacrificed and retained for collection of otoliths (for aging), ovaries (for analysis of gonadosomatic index and fecundity), stomachs (for diet analysis), bile (for hydrocarbon metabolites) and liver and muscle tissue samples (for hepatosomatic index and tissue metal concentrations).

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Permit No: S-08/09-4009-IN
Region: IN

Species Studied: Beluga whale

Assessment of Contaminants, Disease and Health Effects in Beluga Whales Through Harvest-based Monitoring at Hendrickson Island, Northwest Territories

The objective of this project was to conduct a comprehensive sampling program to study the possible health effects of contaminant exposure on beluga whales.

While many persistent and bioaccumulative contaminants are toxic, little is known about contaminant-related health effects in Arctic biota. Moderate to relatively high levels of several classes of contaminants have been observed in high trophic level marine mammals including Beluga whales (*Delphinapterus leucas*), raising concerns about possible consequences for their health. Evidence from laboratory, captive feeding and field studies suggests that many Persistent Organic Pollutants and related compounds disrupt endocrine processes, and lead to reproductive impairment, increased susceptibility to disease and altered growth and development. These health effects may have population level impacts, including decreased growth, increased rates of mortality and decreased reproductive output. Recent reductions in sea ice concentrations in the Western Arctic will likely impact contaminant pathways, food web productivity and beluga feeding ecology, the results of which may signal profound consequences for beluga population health.

Indices of health measurements including vitamin A, thyroid hormone levels, hormone receptors and contaminant metabolites, in addition to general indicators of condition/nutritional stress such as blubber thickness, lipid classes and fatty acids were collected. Community beluga samplers made biological measurements and collected sample tissue (e.g. blubber, liver, kidney, muscle/meat, skin, blood, reproductive organs etc.) during regular subsistence hunts at their respective whaling camps. The hunters permitted access to their landed whales for sampling (aging structures, tissues for contaminants testing and disease testing) and measuring (girth, length, fatness).

These results are being used to create risk-based assessment of contaminants in beluga tissues.

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Permit No: S-08/09-4017-IN

Fish Species Studied: Lake Whitefish

Region: SA

2008 Environmental Surveys at Nico Property

See **Goad, Robin**, NWT Scientific Research Licence No. 14355 on page 4 for research summary.

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Permit No: S-08/09-4019-IN

Fish Species Studied: All species

Region: GW, SA, IN, DC

Distribution and Habitat Use of Sensitive Fish Species in the Mackenzie River Valley and North Slope

The objectives of this study were to 1) Collect information on distribution and habitat use for fish species, which are sensitive to environmental impacts, in selected streams and lakes of the Mackenzie River Valley; 2) develop a database of new and updated information describing distribution, life history and habitat use for fish species found in lakes and rivers of the Mackenzie River Valley.

Hydrocarbon exploration and development is moving at a rapid pace in northern Canada. Recently, hydrocarbon development has intensified in the Northwest Territories; specifically with the proposed Mackenzie Gas Pipeline. Although the general distributions of sensitive fish species in the Mackenzie Valley are known, critical habitat use in relation to life history for many species is poorly understood. This knowledge gap increases potential vulnerability of these species to environmental effects associated with existing and possible development activities. This research helps to provide federal regulators and fish habitat managers with key knowledge regarding fish habitat (e.g., description and map of critical habitat) and tools (e.g., practical indices of critical habitat) which will improve management of sensitive fish populations and establish the foundation for sound and efficient regulatory review of development proposals.

Sampling was conducted in the Deh Cho, Sahtu, Gwich'in and Inuvialuit Regions. Selected streams were sampled once during the summer or fall. From living samples, fork length (nearest mm), sex and maturity were recorded. Weight (nearest gram) was recorded for a sub-sample of live released fish. Life history type and life stage was assigned based on external characteristics, such as size, color and presence of unique marks (e.g., parr marks). Once biological data are taken, fish (>200 mm) were fitted with floy-tags (yellow and orange) and released back into the stream where they were originally captured.

A sub-sample of fish were also sacrificed to confirm species identity and obtain additional biological information. Fish were identified to species, fork lengths (nearest mm) and weight (nearest 0.1 g). Researchers also documented sex, maturity and gonad weight (nearest 0.1 g) for Arctic grayling, bull trout, burbot and Dolly Varden. Sexual maturity was determined by internal examination of gonads. Fish were aged using whole and sectioned otolith methods. All charr captured were identified to species using a linear discriminant function based on external morphological features and genetic analyses.

Since the primary objective of this study was to determine fish presence and quantify the habitat they occupy, a variety of sampling gear were employed such as multi-mesh (3/4" – 5.5") gillnets, angling, electrofishing and set lines.

Due to the high sensitivity of most species in the area (e.g., Arctic grayling, bull trout) nets were fished for 3-6 hours to maximize potential yield and minimize mortality. Measurements of the physical habitat in randomly selected reaches of the streams were conducted.

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Permit No: S-08/09-4020-IN **Fish Species Studied:** Dolly Varden
Region: GW, IN

Distribution and Habitat Use of Dolly Varden and Associated Sensitive Fish Species in the Northwest Territories

The objectives of this study were to 1) Collect information on distribution and habitat use for fish species, which are sensitive to environmental impacts, in selected streams of the North Slope; 2) develop a database of new and updated information describing distribution, life history and habitat use for fish species found in rivers of the North Slope.

Northern form Dolly Varden populations occurring in rivers of the North Slope have declined during the past twenty years. Although population sizes for select populations (i.e., Rat and Big Fish River) have been monitored closely during the past ten years, quantitative data of critical habitat use in relation to life history for west side Dolly Varden stocks is sparse. This knowledge gap increases potential vulnerability of this species to environmental effects associated with existing and possible development activities. This research helped provide northern management boards, local communities, federal regulators and fish habitat managers, with key knowledge regarding fish habitat (e.g. description and map of critical habitat) and tools (e.g. practical indices of critical habitat) which will improve management of sensitive fish populations and establish the foundation for sound and efficient regulatory review of development proposals.

Sampling was conducted in the Gwich'in and Inuvialuit Regions. Selected streams were sampled once during the fall. Dolly Varden and associated fish were monitored through direct observation from the bank or using snorkel surveys where possible. Fish were only captured using seine nets to determine the presence and/or abundance of Dolly Varden in both anadromous and resident forms. Fish were handled to remove them from the net. All fish captured were placed back into the river where they were caught.

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Permit No: S-08/09-4003-IN **Fish Species Studied:** Arctic cisco
Region: SA

Molecular and Otolith Tools to Investigate Population of Origin of Arctic Cisco

See **Nielsen, Jennifer**, NWT Scientific Research Licence No. 14343 on page 9 for research summary.

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Permit No: S-08/09-4006-IN **Fish Species Studied:** Arctic grayling
Region: NS

2008 Field Monitoring – Matthews Lake and Area Fish Habitat Restoration and Enhancement Project

See **Scott, Janet**, NWT Scientific Research Licence No. 14361 on page 10 for research summary.

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Permit No: S-08/09-4001-IN
Region: SS

Fish Species Studied: Stickleback

Molecular Analysis of Evolutionary Change In Stickleback Populations

See Shapiro, Michael, NWT Scientific Research Licence No. 14339 on page 11 for research summary.

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Permit No: S-08/09-4011-IN
Region: SS

Fish Species Studied: Inconnu

Buffalo River Inconnu

The purpose of this project was to continue the program that was initiated to assess the status of the Buffalo River inconnu stocks including tagging and catch per unit effort species composition.

The Department of Fisheries and Oceans Fisheries Management and Science require population and catch data on the Buffalo River inconnu as part of ongoing stock monitoring. Extensive data has been modeled for this population using the Department of Fisheries and Oceans precautionary approach which indicates this stock is near the "critical" zone and as such requires ongoing monitoring via collection of biological and catch per unit effort data (weight, length, age and sex) from dead samples. Live caught inconnu (salmon and trap nets) need to be floy tagged to assist in tracking their movements through the commercial fishery catch. Lengths and scale samples are also needed to be taken from live inconnu samples.

250 inconnu were caught and marked using gillnets and a trap net which were monitored continuously throughout the tagging portion of the study. These fish were measured for length, a scale sample collected and a floy tag attached to them before they are released. Lengths, weights, sex, maturity and aging structures were collected from all mortalities encountered during this segment of the study.

The catch per unit effort portion of the program was conducted by setting gillnets over-night (twelve hours) to determine the catch per unit of effort. All inconnu caught were weighed, measured for fork length, sex and maturity recorded and ageing structures collected. 250 inconnu were dead sampled in this portion of the study.

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Permit No: S-08/09-4021-IN
Region: DC

Fish Species Studied: Lake trout

Stock Assessment of Lake Trout in Trout Lake

The objectives of this study were 1) to collect biological information that can be used to determine the population structure of lake trout; 2) to record catch effort data from multiple scientific gill net sets to determine abundance (i.e. catch per unit effort) of lake trout

This project included the setting of standard scientific gangs (2.25" – 5") throughout the Trout Lake with each set being up to eighteen hours (+/- two hours) in duration. Upon setting of the gill net the location data including coordinates, date, time, water temperature, weather and any other environmental conditions were recorded. In order

to determine catch per unit effort for each set the mesh size, net type, set time, lift time and soak time was also recorded. Biological sampling involved collecting information on round weight, fork length, sex, maturity, stomach contents and the removal of structures to determine age.

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Permit No: S-08/09-4023-IN
Region: SS

Fish Species Studied: Lake whitefish

Hay River Domestic Area Baseline Stock Study

The purpose of this study was to collect baseline population data on fish stocks, particularly lake whitefish, in the Hay River Domestic Area for use in future management decisions.

Except for a previous study of a spawning whitefish run into the Hay River, there has been a lack of fish stock data within the Hay River Domestic Area. The area was closed to commercial fishing at the inception of the Great Slave Lake commercial fishery in the mid-1940s. The area has been and continues to be used by First Nations to fish for subsistence purposes including members of the K'atl'odeeche and West Point First Nations. The First Nations have had concerns about the abundance, size and quality of lake whitefish caught in the area. Documentation of the status of fish stocks in the area are also needed before Hay River harbor and barge activity increase with the potential construction of the Mackenzie Valley pipeline.

Gangs consisting of 45.5 meter sections of 89, 114, 127, 133 and 139 mm gillnet were set in various areas of the Hay River Domestic Area to collect data on species composition and catch per unit effort. The catch was sampled for fork length, round weight, sex and maturity and aging structures. All fish were checked for obvious disease symptoms.

In addition to the biological component, flesh samples and sediment samples were collected for baseline contaminant analysis.

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Permit No: S-08/09-4009-IN
Region: IN

Fish Species Studied: Burbot

Burbot Liver Study

See **Thompson, Amy**, NWT Scientific Research Licence No. 14364 on page 12 for research summary.

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Permit No: X1-08/09-4000-IN
Region: IN

Fish Species Studied: Arctic charr

Stage 1 Feasibility Study – Commercial Arctic Charr Fishery in Ulukhaktok, NT

The objective of this study was to catch and sell 500 Arctic Charr to determine the feasibility of establishing a small commercial fishery in the Ulukhaktok coastal area.

Arctic Charr are managed under the Ulukhaktok Charr Fishing Plan. Subsistence, recreational and commercial fisheries are included in the Plan. The Plan includes a provision for a small coastal commercial fishery of five hundred charr. Subsistence harvest information is collected each year.

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Fish Species Studied: Arctic grayling

Region: NS

Baker Creek Fish Survey-Reach 4

The objectives of the fish and fish habitat monitoring program were to: 1) provide evidence of successful spawning by Arctic grayling; 2) describe spawning habitat for Arctic grayling in Reach 4 and attempt to quantify the number of spawners; 3) observe and describe habitat use by year over year while in Baker Creek prior to outmigration; 4) determine food availability for life stages of Grayling in Reach 4 (one riffle/pool complex).

In 2006, portions of Baker Creek were rerouted and modifications were made to provide 2,100 m² of long-term, natural stream conditions with a variety of hydraulic habitats suitable for Arctic grayling (*Thymallus arcticus*) spawning, rearing and over-wintering habitats. This monitoring plan sampled and monitors: 1) egg deposition; 2) young-of-year adult habitat distribution; 3) young-of-year habitat use and food availability; 4) adult spawning fish; 5) adult abundance estimates; 6) sedimentation, water quality and discharge samples; and 7) culvert assessment as a potential barrier to fish movement.



Photo Credit: Joost Van Der Sanden, Natural Resources Canada

Glossary

Abiotic - Not living

Active layer - The area where the soil continually freezes and thaws above the permafrost

Adaptation - A process by which a living organism (human, animal or plant) changes to become better suited to a new environment. This generally on an evolutionary timescale however, in the human context, it may be over a short period.

Adipose - Of, relating to, or composed of animal fat; fatty

Aerial - In the air

Aeromagnetic survey - Surveys from aircraft that make use of the magnetic field caused by magnetized rocks in the Earth's crust to make estimates about underlying geology of a given area such as distribution of potential resources

Algae - Simple living aquatic single or multi celled plant organisms that contains chlorophyll

Algorithm - A procedure or formula for solving a problem

Alkali - A basic substance that can range in strength

Analytical - A detailed examination of the structure or some other parameter of a substance or thing

Anoxic - A situation where oxygen is present in very low amounts or not at all, common in water

Annual - Occurs every year

Anthropogenic - Caused by a human action

Anthropology - The study of the human beings including their origins, cultures, evolution

Aquatic - Of water

Aquatic Biota - All living organisms in the aquatic environment

Arable - Land fit to be cultivated

Archaeology - The study of past human life and culture by looking at remains and artifacts like tools

Archean - A period of geologic time from about 3.9 billion years to 2.5 billion years ago

Archival - Pertaining to a collection of documents, normal over long periods of time

Arsenic - A chemical element that is gray in color and that is highly poisonous with no taste

Artifact - A historical tool, weapon or other human-made object that can be studied

Asexual - An organism that reproduces without the aid of a partner and who passes on all of its genetic information

Atmosphere - The layers of gases that surround and protect the Earth

Attributed - To explain by indicating a cause

Avifauna - the birds of a particular region or period

Bacteria - A large and varied group of single-celled microorganisms

Baseline - A set of information and data serving as a basis for comparison into the future

Bathymetry - Underwater topography. Mapping the underwater contours of the bottoms of water bodies

Beaufort Gyre - The major ice and ocean current circulation of the Arctic Ocean

Benthos - The bottom of the ocean or body of water

Biochemistry - The study of chemical processes in living organisms

Biodiversity - Pertaining to the variety of species in an area

Biogenic - Produced by living organisms or biological processes

Biogeography - The study of the geographical distribution of organisms

Biomass - The total amount of all living material within a specific volume of the environment

Biomes - Distinct areas of the Earth that are common in climate conditions, life forms and physical features like the tundra or woodland

Biostratigraphy - Identification and differentiation of rocks based on the types of fossils they contain

Biotic - Having to do with living organisms

Boreal - Relating to the forest areas of the Northern Temperate Zone that are dominated by coniferous trees such as spruce, fir and pine

Brachiopods - Any of various marine invertebrates of the phylum Brachiopoda, having bivalve dorsal and ventral shells enclosing a pair of tentacled, armlike structures that are used to sweep minute food particles into the mouth. Also called *lampshell*.

Breccia - Rock composed of sharp-angled fragments embedded in a fine-grained matrix

Brunisol Soil - soil type that is associated with forest vegetation. It is usually poorly developed and immature

Carbon¹⁴ - A radioactive isotope of carbon used to date ancient rocks and artifacts

Carnivore - A flesh/meat eating animal

Characterized - To describe an object or idea

Chlorophyll A - A pigment in plants that give them their green color and which absorb energy from the sun. Plants use Chlorophyll to change carbon dioxide and water into food and oxygen

Classification - Organize into groups or categories

Climate - Typical weather patterns of a region over long time periods

Community - All organisms in a particular environment

Comprehend - Being able to understand

Comprehensive - Conveying or including everything or almost everything

Coniferous woodland - A wooded area that is dominated by evergreen trees

Conifers - A group of woody plant commonly known as evergreen trees such as pine, spruce or fir that bears cones

Connectivity - As something is able to connect or relate with another thing

Core - A part removed from the interior of a mass especially to determine the interior composition

Correlated - A mutual relation between two comparable things

Cretaceous - Of or belonging to the geologic time, system of rocks and sedimentary deposits of the third and last period of the Mesozoic Era, characterized by the development of flowering plants and ending with the sudden extinction of the dinosaurs and many other forms of life

Crustacean - any mainly aquatic arthropod usually having a segmented body and chitinous exoskeleton

Cryosols - Cryosols are characterized by frozen soil within 1 metre (39 inches) of the land surface and by waterlogging during periods of thaw. They often show disrupted soil layers, cracks, or patterned surface features such as frost mounds, caused by the physical actions of ice formation and melting. Cryosols may be either mineral soils or humus-rich materials

Cryosphere - frozen water in the form of snow, permanently frozen ground (permafrost), floating ice and glaciers

Cumulative - Objects or ideas that add together

Cyanobacteria - predominantly photosynthetic prokaryotic organisms containing a blue pigment in addition to chlorophyll; occur singly or in colonies in diverse habitats; important as phytoplankton

Deciduous - A plant that lose their leaves during one season, usually winter

Deducing - To draw a conclusion

Deformation - A measurable change in structure, normally for the worse

Degradation - To reduce something or to place something at a lower level

Delta - The land formed where a river deposited silt as it enters into a larger water body, classic example, the Mackenzie Delta

Dendrochronology - A system of dating wooden objects by studying the tree growth rings

Density - A quantity of mass per unit volume

Devonian - Of or belonging to the geologic time, system of rocks, or sedimentary deposits of the fourth period of the Paleozoic Era, characterized by the development of lobe-finned fishes, the appearance of amphibians and insects and the first forests

Discontinuous - Not continuing or linked

Diurnal - Relating to or occurring in a 24-hour period; daily. Occurring or active during the daytime rather than at night

Diversion - A changing of the direction an object is going

Ecology - The science that deals with how living organisms live in relation to each other and their environment

Ecological integrity - Ensuring the relationship in plant and animal communities remains healthy

Ecosystem - The organisms present in a defined area and how they interact with the non-living surrounding (the biotic and the abiotic)

Effluent - A pollutant that flows out from a main source, such as sewage or waste matter

Ekman Grab - A box core type of sediment sampling device.

ELC data - Ecological Land Classification data

Electrofishing - Using electricity to stun and kill fish, usually used during scientific scenarios

Electromagnetic - Magnetism that is caused by electricity

Emissions - A water product that is radiated outward or discharged from a source

Endocrine - 1) designating or of any gland producing one or more hormones 2) designating or of such a hormone

Endophyte - An organism, especially a fungus or microorganism, that lives inside a plant, in a parasitic or mutualistic relationship

Environment - An organism's physical surroundings

Epoch - A period of time during which something important developed or happened

Erosion - Group of natural processes (weathering, disintegration, abrasion, corrosion, transportation) where the Earth's surface is worn away and removed

Eskers - A long, narrow ridge of coarse gravel deposited by a stream flowing under a decaying glacial sheet of ice

Estuary - A place where coastal seawater comes into contact with the current of a freshwater stream

Eukaryote - any member of the *Eukarya*, a domain of organisms having cells each with a distinct nucleus within which the genetic material is contained. Eukaryotes include protoctists, fungi, plants and animals

Eutrophication - The enrichment of aquatic systems, promoting dense algal and plant growth in a body of water, depriving the water of oxygen and forcing change in species composition

Evaporites A sedimentary deposit that results from the evaporation of seawater

Evolution - A process where different species come into existence by differentiation and genetic mutations from common ancestors over a long period of time.

Excavated - Extracting or revealing something by removal of the surrounding earth

Fauna - Animal life of a particular region, environment, or geological period

Fault - A fracture in a rock along which the rocks move; the place of origination of seismic activity; types include: strike-slip and thrust

Fecundity - Ability to reproduce

Fen - Low, flat, swampy land; a bog or marsh

Flora - The plants of a particular region, environment or geological region

Fluvial - Pertaining to something's existence or growth around a stream or river

Fossil -Trace of an organism of a past age, embedded and preserved in the Earth's crust

Fry - Infant fish

Fungi - A kingdom of heterotrophic organisms that produce spores

Fyke - A long, bag-shaped fishing net held open by hoops

Gas hydrates (clathrates) - Crystalline water based solids physically resembling ice, in which small non polar molecules (typically gases) are trapped inside "cages" of hydrogen bonded water molecules

Gender - One's characteristics or traits determined socially as a result of one's sex

Genetic - Pertaining to an organism's traits or characters being linked to genes

Genera - A group of organisms that share common characteristics

Geochemistry - The science that deals with the chemical composition of and chemical changes in the solid matter of the Earth

Geochronological - The chronology of the earth's history as determined by geologic events and not by human history

Geomorphologic - Pertaining to the physical features of the Earth's surface

Glauconite - A greenish mineral of the mica group, a hydrous silicate of potassium, iron, aluminum, or magnesium

Gonad - a gland in which gametes (sex cells) are produced

Grams (g) - A unit of measurement for mass

Habitat - A place where organisms live

Hepatic - (Anatomy) of or relating to the liver; (Botany) *botany* of or relating to the liverworts

Heterogeneous - A situation where something is in a mixed composition

Holocene - The most recent 11,000 years of the Earth's history starting at the end of the last major iceage, which has been relatively warm

Hydraulic - Pertaining to movement caused by water

Hydroacoustic survey - An echo-sounding (SONAR) survey used for measuring such things as fish stocks, water velocity, etc.

Hydrocarbon - A molecule containing hydrogen and carbon, often petroleum, natural gas and coal

Hydrograph - A graph showing the water level, discharge, or other property of river volume with respect to time

Hydrology - Science dealing with the properties, distribution and circulation of water

Isotope - Atoms that have nuclei with the same number of protons (as the atomic number) but different numbers of neutrons

Igneous - A rock or mineral that solidified from molten or partly molten material, i.e. from magma; one of three rock types with metamorphic and sedimentary

Implement - To put into effect

Iron - A metallic element used for making tools and essential for all living organisms' survival

Jarosite - a yellow to brown secondary mineral consisting of basic hydrated sulphate of iron and potassium in masses or hexagonal crystals

Kimberlite - An igneous that forms in volcanic pipe, an indicator of diamond deposits

Larvae - A premature stage for an insect where it feeds before becoming a pupa

Latitude - A measurement of the from the equator to a given point on the Earth's surface in the north and south direction

Laurentide Ice Sheet - Principal glacial cover of North America during the Pleistocene Epoch (2.6 million - 11,700 years ago). At its maximum extent it spread as far south as latitude 37° N and covered an area of more than 5 million sq mi (13 million sq km). In some areas its thickness reached 8,000 - 10,000 ft (2,400 - 3,000 m) or more

Ligotrophic (oligotrophic) - The opposite of eutrophic. Waters having very low levels of primary productivity and (usually) low concentrations of nutrients, good, clear water quality

Limestone - A sedimentary rock that contains mostly calcium carbonate and can be formed by either inorganic or organic processes

Limnology - The scientific study of the life and phenomena of fresh water, especially lakes and ponds

Lithic - Of, like, or made of stone. Archaeological artifacts made of stone

Meristic - Having or composed of segments; segmented

Mesic - Of, characterized by, or adapted to a moderately moist habitat

Metabolism - The chemical processes occurring within a living cell or organism that are necessary for the maintenance of life. In metabolism some substances are broken down to yield energy for vital processes while other substances, necessary for life, are synthesized

Metamorphic rock - Any rock derived from pre-existing rocks by changes in response to environmental factors such as temperature and pressure over a long period of time; one of three types of rocks with igneous and sedimentary

Methane - The simplest hydrocarbon that is the main ingredient in natural gas (CH₄)

Microclimate - The climate of a small area that is different due to changes in geography

Microorganisms - Organisms that must be viewed under a microscope, such as bacteria or a virus

Migration - The long range movement of a group of animals based on the seasons

Molecular analysis - A detailed look at the chemical structure and properties of a molecule

Moraine - A mound of rock debris carried and deposited by a glacier

Multicellular - Composed of more than one cell

Nutrient - Any chemical that an organism removes from the environment to aid with growth and development; common nutrients include nitrogen and phosphorus

Otolith - A part of a fish's inner ear, often used to determine the age fish

Organic - Material pertaining to plants or animals

Outcrop - A portion of bedrock or other stratum protruding through the soil level

Overlie - Sedimentary or volcanic rock that lies on top of older rock

Paleoecological - A relationship or study of ancient organisms and how they related to their ancient environment

Paleoenvironmental - An environment that existed in the past

Parr - a juvenile fish

Parameter - One set of measurable factors, such as the temperature and pressure that define a system and determine its behavior and are varied in an experiment

Pelagic - Relating to or living in or on oceanic waters. The pelagic zone of the ocean begins at the low tide mark and includes the entire oceanic water column

Permafrost - The permanently frozen layer of soil that characterizes the Arctic's ground; there are two various types: continuous and discontinuous

Pertinent - An object, idea or concept that is relevant to the topic

Phylogeography - the study of the historical processes that may be responsible for the contemporary geographic distributions of individuals

Phylum - (Biology) a major taxonomic division of living organisms that contain one or more classes. An example is the phylum *Arthropoda* (insects, crustaceans, arachnids, etc., and myriapods)

Physiological - Pertaining to the physical structures and functions of living organisms

Phytoplankton - A group of plant-like plankton that all sea animals depend on either directly or indirectly

Pingo - A large frozen mound covered with vegetation in permafrost areas

Pleistocene - An age of notable ice ages and development of humans between 2,000,000 and 10,000 years ago

Postglacial - Relating to or occurring during the time following a glacial period

ppm - An abbreviation of parts per million

Precipitation - Water (in the form of rain, snow, hail, etc) falling from the atmosphere

Prokaryote - An organism of the kingdom Monera (or Prokaryotae), comprising the bacteria and cyanobacteria, characterized by the absence of a distinct, membrane-bound nucleus or membrane-bound organelles, and by DNA that is not organized into chromosomes. Also called *moneran*

Qualitative - A complete detailed descriptions usually taken from a small sample that allows for distinctions to be drawn from the data

Quantitative - Use of large amounts of data where statistics can be applied to interpret the data

Quaternary - Of or belonging to the geologic time, system of rocks, or sedimentary deposits of the second period of the Cenozoic Era, from the end of the Tertiary Period through the present, characterized by the appearance and development of humans and including the Pleistocene and Holocene epochs

Qiviuk - The soft downy undercoat of muskoxen

Radiocarbon dating - The determination of the approximate age of an ancient object, such as an archaeological specimen, by measuring the amount of carbon¹⁴ it contains

Raptor - A bird of prey such as an eagle, falcon or osprey

Regolith - The layer of loose rock resting on bedrock, constituting the surface of most land. Also called *mantle rock*

Regosol - a type of azonal soil consisting of unconsolidated material derived from freshly deposited alluvium or sands

Remote Sensing - A technique used to study locations using technology that does not require the researcher to be in the field

Revitalization - To give new life or vitality to something

Riffle – a) A rocky shoal or sandbar lying just below the surface of a waterway b) A stretch of choppy water caused by such a shoal or sandbar; a rapid

Satellite imagery - Computer images generated by a satellite which allow researchers to look at a specific area and monitor surface features such as vegetation

Sediment - Solid fragment material that occurs from the weathering of rocks. In water it is material that has settled from a state of suspension

Sedimentary rock - Rock derived from loose particles that have accumulated over time

Sedimentation - The process where small particles are moved and deposited to accumulate into layers

Seine - A large fishing net made to hang vertically in the water by weights at the lower edge and floats at the top

Seismic - Pertaining to vibrations in the Earth, both natural and induced

Shovel testing - A simple test where a sample of ground is taken by use of a shovel and examined

Species - A group of organisms that share common characteristics that group them together and also distinguish them from others

Stone flakes/chards - debris left over from a rock while making tools

Stratified - A system that is set up in layers or strata

Stratigraphic - Formation of rock where different layers can be picked out based on type and age of the rock

Subsidence - The shifting of the Earth's surface downwards (compared normally to sea-level)

Succession - A progressive change in the biological community as a result of a response from species to the changing environment

Surficial - Pertaining to something that is on the surface

Suspension - A situation where the medium is able to support the weight of the particles trapped inside it, example: silt in a river.

Symbioses - An interaction between two or more organisms that usually benefits both

Sympatric - Occupying the same or overlapping geographic areas without interbreeding. Used of populations of closely related species

Systematic - Done according to a plan

Taxonomy - The classification of organisms in an ordered system that indicates natural relationships

Thermokarst - Sinking holes, caves and underground drainage that are produced in regions with permafrost from melting of ground ice and settling of the remaining ground

Theodolite - a surveying instrument for measuring vertical and horizontal angles. Also called (in the US and Canada) **transit**

Thermocline - Layer in a large body of water that sharply separates regions differing in temperature. An abrupt temperature gradient in a lake

Topography - A description of the surface of a given area

Trace metals - A metal that is not essential in the sample but is found in small quantities

Transect - An imaginary line across a surface where observations are made

Tributary - A stream or river which feeds into a larger body of water

Turbid - Stirred up material suspended in a medium leaving it unclear and opaque

Ungulate - Hoofed animals

Velocity - Rate of change of position; quickness of motion

Volatile - Unstable; a substance that easily vapourizes

Watershed - A region draining into a river, river system, or other body of water

Weather - Daily variable changes in temperature, precipitation, wind and other atmospheric conditions

Zooplankton - Microscopic animal organisms floating in water

210-Pb Method - is used to determine the accumulation rate of sediments in lakes, oceans and other water bodies. It is used for over a period of 100 - 200 years.

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